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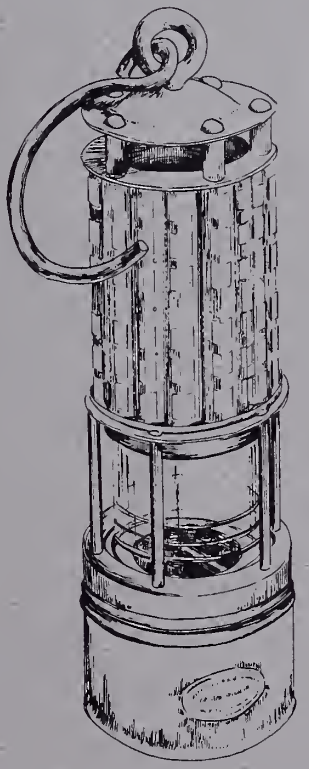
Montana. Dept. of
State Lands
Meridian
Minerals Company's
proposed
development of the
Bull Mountains

Draft Environmental Impact Statement

MERIDIAN MINERALS COMPANY
BULL MOUNTAINS MINE NO. 1
MUSSELLSHELL AND YELLOWSTONE COUNTIES, MONTANA



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DEPARTMENT OF STATE LANDS

STAN STEPHENS, GOVERNOR

CAPITOL STATION

STATE OF MONTANA

(406) 444-2074

1625 ELEVENTH AVENUE
HELENA, MONTANA 59620

August 31, 1992

Dear Reader:

Enclosed for your review and comment is a copy of the draft Environmental Impact Statement (EIS) for Meridian Minerals Company's Bull Mountains Mine No, 1.

Three formal public hearings will be held to receive and record oral comments on this draft EIS.

- The first will be in Huntley, 7:30 pm, September 22, 1992 in the Hospitality Room of the Yellowstone Valley Electric Co-op., 113 Northern Avenue.
- The second will be 7:30 pm, September 23, 1992, in the Lewis & Clark Room of the Student Union Building, Eastern Montana College, Billings.
- The third will be 7:30 pm September 24, 1992 in the Central School cafeteria in Roundup.

The comment period will end October 5, 1992. The purpose of the comment period is to provide an opportunity for the public to provide substantive oral and/or written comment on the draft EIS. The Agency wants to be sure that all appropriate information has been included in the document, all concerns raised during scoping have been adequately addressed and there are no errors in assumptions and analysis.

If you have written comments please address them to:

Mike DaSilva
Environmental Specialist
MT Dept. of State Lands
Capitol Station
Helena, MT 59620

Comments should be postmarked or hand delivered no later than 5 pm, October 5, 1992. Additional copies of this EIS are available at the address listed above.

Sincerely,

Bonnie Lovelace

Bonnie Lovelace, Chief
Coal and Uranium Bureau
Reclamation Division

/ns

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Draft

Environmental Impact Statement

MERIDIAN MINERALS COMPANY'S

Proposed Development of the

BULL MOUNTAINS MINE NO. 1

and

ASSOCIATED SUPPORT FACILITIES

MUSSELLSHELL AND YELLOWSTONE COUNTIES, MONTANA

August 31, 1992

Dennis D. Casey, Commissioner
Department of State Lands

COVER SHEET

Proposed actions: Approval or disapproval of 1) a Montana 5-year *permit to mine coal,* and 2) a Montana *land use agreement* being requested by Meridian Minerals Company for the construction and operation of the Bull Mountains Mine No. 1 and its associated support facilities.

In addition, approval or disapproval of 1) successive amendments of the Montana *permit to mine coal*, 2) a Montana *coal lease*, 3) a Federal *permit to mine coal,* and 4) a Federal *surface use permit* may be requested in the future for life-of-mine development.

Type of statement: Draft environmental impact statement (EIS)

Lead agency: State of Montana,
Department of State Lands (Montana DSL)

For further information:
Bonnie Lovelace, Chief, Coal and Uranium Bureau
Attn: Mike DaSilva
Montana Department of State Lands
Capitol Station
Helena, Montana 59620
(406) 444-2074

Abstract:

Meridian Minerals Company proposes to construct and operate the Bull Mountains Mine No. 1, an underground coal mine located in Musselshell and Yellowstone counties, about 35 miles northeast of Billings and 16 miles southeast of Roundup, Montana. Support facilities for the proposed mine would be located throughout Musselshell and Yellowstone counties.

The proposed Project has five elements: 1) the mine and its facilities; 2) a temporary upgrade of the existing Montana Rail Link rail loadout near Huntley; 3) a proposed 33-mile

rail spur from the Burlington Northern mainline south of Broadview; 4) a 17-mile upgrade and extension of the Fergus Electric Cooperative power transmission line from the city of Roundup; and 5) limited wetland enhancement activities outside the life-of-mine area.

The Bull Mountains Mine No. 1 and its support facilities (the Project), would occupy about 12,115 acres, and could eventually disturb about 8,250 of those acres. The proposed mine would be in operation for about 44 years and would eventually recover 100 million tons of clean coal using both longwall and room-and-pillar mining methods. During full production, about 300 people would be employed by Meridian.

The specific action requested is to approve a 5-year permit. MSURMA requires Montana DSL to analyze the life-of-mine proposal, however, permits are granted for 5-year periods. Meridian's current permit application is only for the area proposed to be reviewed in the first 5 years of the mine life. The 5-year permit would encompass 4,216.91 acres, of which 4,022.95 are privately owned, 40 are owned by the State of Montana, and 153.96 are federally owned. Of the mineral ownership in the 5-year permit area, 2,075.60 acres are privately owned, 40 acres are owned by the State of Montana, and 2,101.31 acres are federally owned.

PREFACE

An EIS is not usually read like a book, from the first page to the end. The best way to go about reading an EIS depends on your interests. You may be more interested in impacts, while others might have more interest in the details of the proposed plan or opportunities made available for public involvement in the environmental assessment process. Many readers probably just want to know what is being proposed and how it will affect them.

The following paragraphs outline information contained in the chapters and appendices so that readers may find the parts of interest without having to read the entire document.

The Summary is a short, simple discussion to provide the reader and the decision makers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more detailed information from the actual text of the EIS.

Chapter I is the first section of the EIS. It introduces the reader to the Project, the agencies involved, the major issues associated with the Project, and the underlying purpose of, and need for the EIS.

Chapter II identifies the pertinent components of the primary alternatives analyzed in Chapter IV. All other alternatives, considered but not analyzed, are identified along with the rationale for not including them in the analysis. This chapter also provides a comparative analysis of the environmental impacts of the primary alternatives to provide a clear basis of choice among options for the decision maker and the public.

Chapter III describes the current condition of resources that are expected to be affected by the alternatives under analysis in Chapter IV.

Chapter IV is the most important section of the EIS. Here you find discussion of expected impacts to the human environment, both with and without the Project.

Chapter V lists the agencies consulted during the preparation of this EIS and describes opportunities made available for public participation. It also discusses issues brought up by the public and considered but not analyzed in Chapter IV, along with the reason for not including them in the Chapter IV analysis.

Chapter VI lists interdisciplinary team members responsible for preparation of the EIS.

Chapter VII lists references cited in the EIS.

Appendix A provides a complete, concise description of the Project as proposed by the applicant.

Appendix B is a description of the various projects, in progress or expected to occur in the reasonably foreseeable future, that were considered in the cumulative analysis.

Appendix C explains the different aspects of room-and-pillar and longwall mining.

Appendix D discusses the role various State and Federal agencies have in evaluating the merits of, and in approving or regulating the proposed Project. It also lists agencies having jurisdiction over the Project along with the statutes that give them authority.

Appendix E is a compilation of technical material used in the development of the EIS.

Appendix F is a glossary of technical or unusual terms or acronyms used in the EIS.

SUMMARY

This environmental impact statement (EIS) identifies and analyzes probable impacts to the human environment that would result should Montana Department of State Lands (Montana DSL) grant a permit for, and Meridian Minerals Company (Meridian) subsequently develop, the proposed Bull Mountains Mine No. 1 and associated facilities (the Project). This EIS also analyses the probable cumulative impacts that would result from the proposed Project in combination with other projects and activities proposed for the area in the reasonably foreseeable future. The other projects and activities included in the cumulative analysis were: the PM Mine, Meridian's coal test pit, the Huntley loadout facility, the Huntley sugar beet loading site, Fergus Electric Cooperative activities, the proposed women's correctional facility, the Cenex hydrosulphurization project, Billings Generation, Inc.'s cogeneration project, U.S. Highway 87 improvements, Sealey's sawmill, Gebhart's post plant and sawmill, and activities of the Burlington Northern Railroad.

Before the Montana DSL could issue a permit to mine coal, Meridian's permit application package (PAP) would have to meet all applicable State and Federal laws and regulations.

Brief description of the proposal

Meridian proposes to develop the Bull Mountains Mine No. 1 as an underground coal mine using primarily longwall mining methods with some room-and-pillar mining. The proposed Project is in the Bull Mountains about 16 miles south of Roundup, Montana and about 35 miles northeast of Billings, Montana. The proposal is to develop the mine to an eventual peak production of 3.3 million tons of clean coal per year. For the first 2 to 3 years, Meridian proposes to produce from about 0.5 million to 1.1 million tons of clean coal per year which would be transported by truck to a temporary rail loading facility at Huntley, Montana. Truck hauling would cease when Meridian finished a 33-mile rail spur from south of Broadview, Montana to the mine site.

The proposed Project would have a total area of about 10,859 acres, a life of about 44 years, and would disturb about 7,041 acres. Livestock grazing and wildlife habitat are the primary current uses of the proposed Project area.

MSUMRA requires Montana DSL to analyze the life-of-mine proposal, however permits are granted for 5-year periods. Meridian's current permit application is only for the area proposed to be reviewed in the first 5 years of mine life. The 5-year permit would encompass 4,216.91 acres, of which 4,022.95 are privately owned, 40 are owned by the State of Montana, and 153.96 are federally owned. Of the mineral ownership in the 5-year permit area, 2,075.60 acres are privately owned, 40 acres are owned by the State of Montana, and 2,101.31 acres are federally owned.

Purpose and need for a State action

Meridian has submitted a PAP to Montana DSL. Under the provisions of the Montana Strip and Underground Mine and Reclamation Act (MSUMRA), Montana DSL has to approve or deny Meridian a permit to mine coal. This EIS analyzes the probable environmental consequences of development that would result from Montana DSL's action.

The first action available to Montana DSL is to approve the proposed mining plan with any conditions needed to bring the proposed Project into compliance with all applicable laws and regulations (Alternative 1, approval of the proposed mining plan, with conditions). The second action is to deny Meridian a permit to mine coal because the proposed project could not comply with the applicable laws and regulations including MSUMRA (Alternative 2, the disapproval alternative).

Comparison of alternatives

This EIS addresses: (1) site-specific impacts to the human environment that could result from development of the proposed Project and (2) cumulative impacts to the human environment that could result from development of the proposed Project in conjunction with other projects or activities occurring or expected to occur in the area in the reasonably foreseeable future.

Under Alternative 1, Montana DSL's analysis found that:

- If mitigation measures failed, there would be major irreversible and irretrievable impacts that could be significant to certain aspects of the resources of hydrology, vegetation, land use and wildlife because ecological function of the impacted water features and stream reaches could not be restored.
- There would be an irretrievable loss of topographical diversity in the waste disposal area.
- There would be an irretrievable loss of vegetative productivity on the area of the rail spur that would not be recontoured and revegetated (non-State-owned parcels).
- There could be a major impact to public safety and traffic flow along the haul routes for the period of time coal would be trucked to Huntley.
- There would be a major impact to visual and aesthetic resources from operation of the temporary coal loadout in Huntley for the 2 to 3 years of operation.
- There could be permanent and potentially major impacts to cultural resources from mining-related disturbances.

Under Alternative 2, the Montana DSL's analysis found that:

- There would be negligible impacts to air quality, geology, topography, soils, hydrology, wildlife, cultural, recreation, and land use.
- There would be negligible to minor impacts to vegetation, transportation, and noise.
- There would be negligible to moderate impacts to socioeconomics and visual resource/aesthetics.
- There would be a loss of some beneficial impacts to socioeconomic and cultural resources.

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CHAPTER I

INTRODUCTION

A. PURPOSE AND NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT

Montana Department of State Lands (DSL) (the Agency) has received a complete permit application package (PAP) from Meridian Minerals Company (Meridian) of Denver, Colorado. The PAP includes a proposed life-of-mine mining plan and information necessary to obtain a State permit to conduct coal mining and reclamation operations at Meridian's proposed Bull Mountains Mine No. 1 in Musselshell and Yellowstone counties, Montana (see Figure I-1).

Meridian has submitted the PAP pursuant to the Montana Strip and Underground Mine Reclamation Act (MSUMRA) of 1973 as amended. MSUMRA requires the responsible officials at Montana DSL to approve, conditionally approve, or disapprove the permit application submitted by Meridian, and, if appropriate, issue a 5-year permit for the Bull Mountains Mine No. 1.

Montana DSL has determined that approval or disapproval of Meridian's permit application constitutes a major action could "significantly affecting the quality of the human environment" and, that pursuant to Section 75-1-201 of the Montana Environmental Policy Act (MEPA), an environmental impact statement (EIS) should be prepared.

B. THE APPLICANT'S PROPOSAL

Meridian proposes to develop the Bull Mountains Mine No. 1, an underground coal mine located in Musselshell and Yellowstone counties, about 35 miles northeast of Billings and 16 miles southeast of Roundup, Montana (see Figure I-2).

Support facilities for the proposed mine would be located throughout Musselshell and Yellowstone counties. The proposed Project has five elements: 1) the mine and its facilities; 2) a temporary upgrade of the existing Montana Rail Link rail loadout near Huntley; 3) a proposed 33-mile rail spur from the Burlington Northern mainline south of Broadview; 4) a 17-mile upgrade and extension of the Fergus Electric Cooperative power transmission line from the city of Roundup; and 5) limited wetland enhancement activities outside the mine area. The Bull Mountains Mine No. 1 and its support facilities (the Project), would occupy about 12,115 acres, and could eventually disturb about 8,250 of those acres.

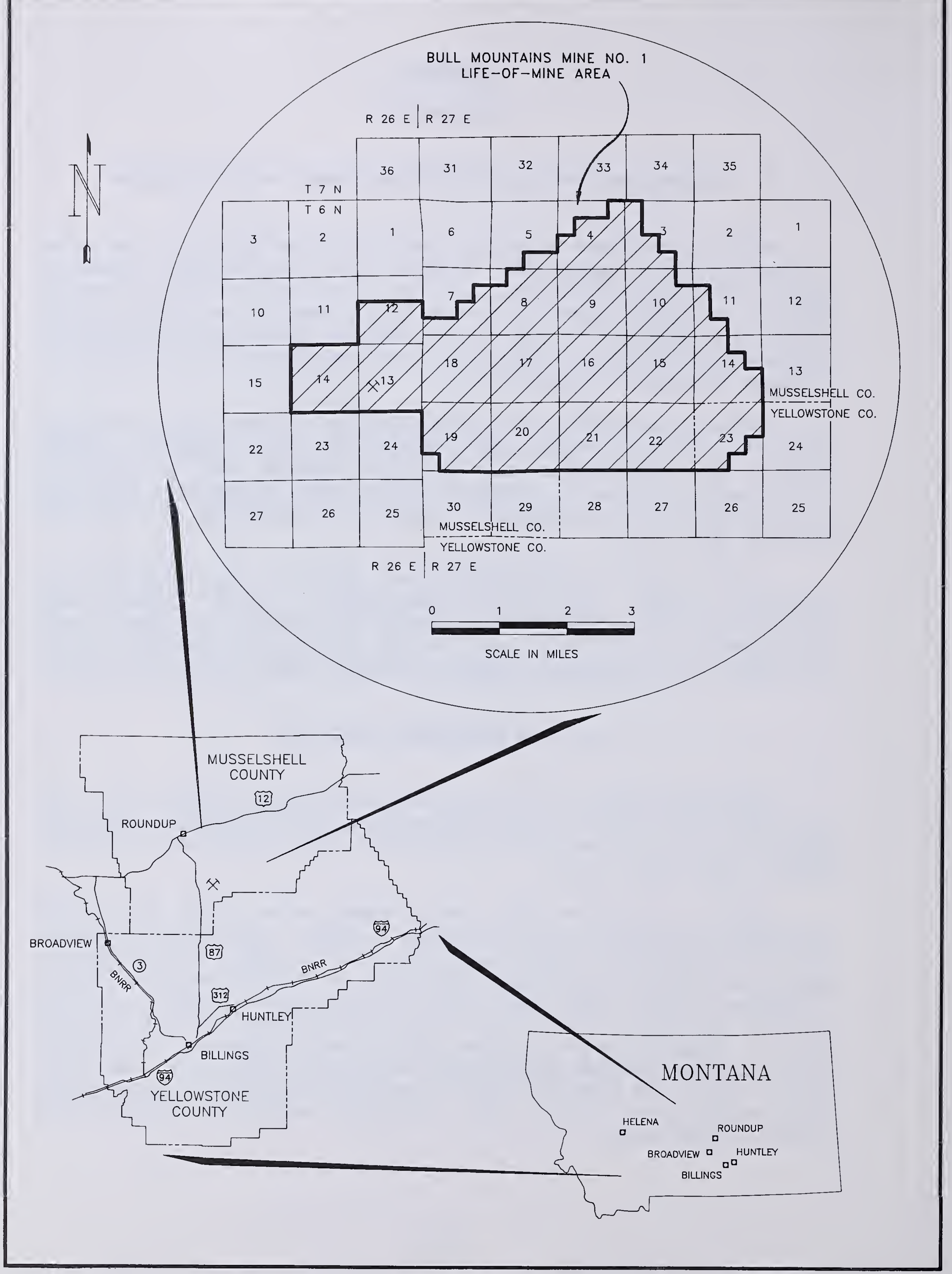
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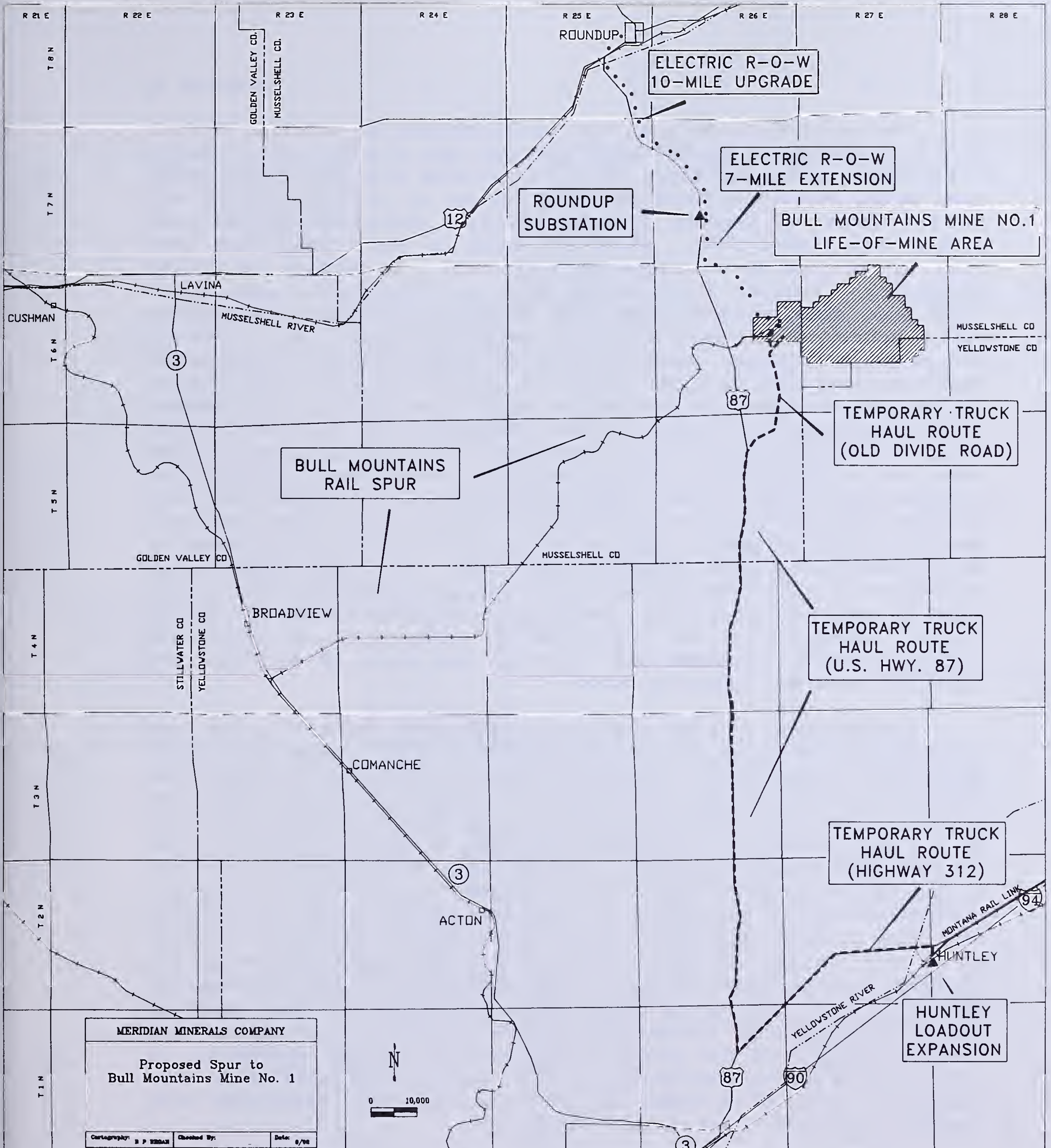
Figure I-1 General location of the proposed Bull Mountains Mine No. 1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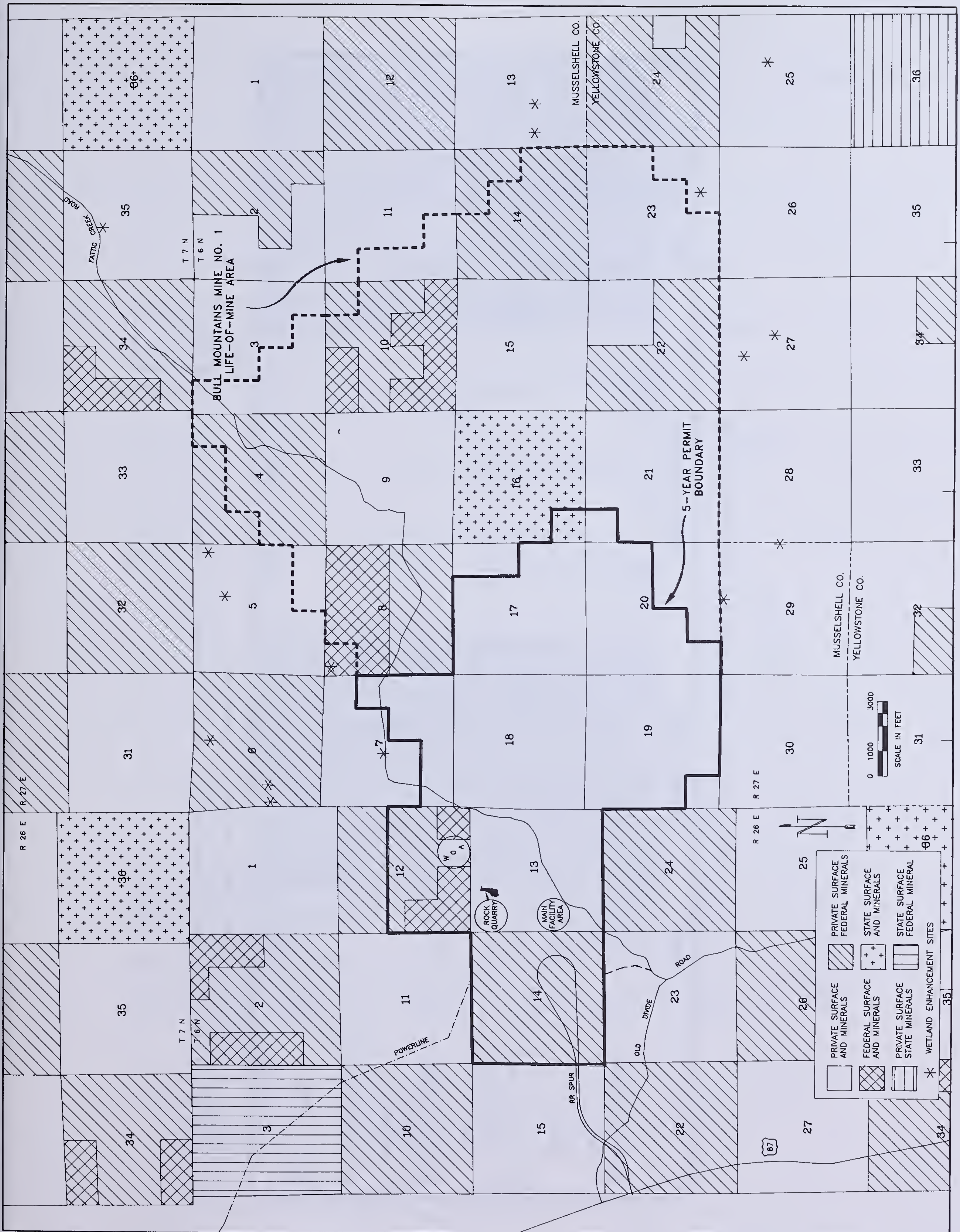
GOLDEN VALLEY CO.
MUSSELSHELL CO.
ELECTRIC R-O-W
7-MILE EXTENSION
ROUNDUP
SUBSTATION
12
BULL MOUNTAINS MINE NO.1
LIFE-OF-MINE AREA
LAVINA
CUSHMAN
MUSSELSHELL RIVER
3
MUSSELSHELL CO
YELLOWSTONE CO
87
TEMPORARY TRUCK
HAUL ROUTE
(OLD DIVIDE ROAD)
BULL MOUNTAINS
RAIL SPUR
GOLDEN VALLEY CO
MUSSELSHELL CO
BROADVIEW
STILLWATER CO
YELLOWSTONE CO
TEMPORARY TRUCK
HAUL ROUTE
(U.S. HWY. 87)
COMANCHE
TEMPORARY TRUCK
HAUL ROUTE
(HIGHWAY 312)
3
MONTANA RAIL LINK
94
ACTON
HUNTLEY
YELLOWSTONE RIVER
HUNTLEY
LOADOUT
EXPANSION
MERIDIAN MINERALS COMPANY
Proposed Spur to
Bull Mountains Mine No. 1
Cartography:
Checked By:
Date:
N
0
10,000
87
90
3
BILLINGS
HESPER

Figure I-2 Specific location of Project elements

The proposed mining operation would convert the existing PM Coal Mine and portions of the adjacent coal test pit site into a full-scale underground mining facility. The life-of-mine area for the proposed mine would contain a total of 10,859 acres of private, State, and Federal lands, 40 percent of which overlies State and Federal coal estate (see Figure I-3). About 871 acres of the life-of-mine area would be occupied by a surface facility complex to service the mining operation. Another 6,170 acres of the life-of-mine area could experience some surface subsidence caused by proposed underground mining activities, or be disturbed by exploratory drilling, hydrologic mitigation activities, ventilation shaft installation, or associated temporary road construction. Table I-1 provides life-of-mine acreages for the proposed mine and its various support facilities. It compares the total acreage requirement for each component with that portion that would be disturbed by Project activities. New disturbance acreages have been separated from those acreages that were already disturbed by previous activities. MSUMRA requires Montana DSL to analyse the life-of-mine proposal, however permits are granted for 5-year periods. Meridian's current permit application is only for the area proposed to be reviewed in the first 5 years of mine life. The 5-year permit would encompass 4,216.91 acres, of which 4,022.95 are privately owned, 40 are owned by the State of Montana, and 153.96 are federally owned. Of the mineral ownership in the 5-year permit area, 2,075.60 acres are privately owned, 40 acres are owned by the State of Montana, and 2,101.31 acres are federally owned.

The proposed mine would be in operation for about 44 years from premining construction and development through bond release after final reclamation (mine life). Meridian proposes to eventually recover 100 million tons of clean coal from the mine using both longwall and room-and-pillar methods. The majority of the production, varying from 0.5 to 3.3 million tons of clean coal per year, would be shipped to both domestic and foreign consumers. In addition, the mine would continue to supply the small, local market currently served by the PM Mine. During the first 2 to 3 years of limited operation while the proposed rail spur is under construction, coal would be hauled by truck about 41 miles over County and State roadways from the proposed mine to the upgraded loadout near Huntley. After completion of the proposed 33-mile rail spur, full-scale operations would begin and coal would be loaded directly onto trains at the mine. Table I-2 identifies the duration of each of the phases of the proposed 44-year operation. A total of 450 people eventually could be employed by Meridian in some capacity. About 88 of these jobs would be temporary, associated with various construction activities (Table I-3).

Specific details of Meridian's proposal are included in Appendix A. Specific details of the existing PM Mine facility and coal test pit are included in Appendix B.


BULL MOUNTAINS MINE NO. 1
LIFE-OF-MINE AREA
5-YEAR PERMIT
BOUNDARY
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
FATTIG CREEK
ROAD
ROCK QUARRY
MAIN FACILITY AREA
W O A
POWERLINE
RR SPUR
OLD DIVIDE ROAD
87
0
1000
3000
SCALE IN FEET
PRIVATE SURFACE AND MINERALS
FEDERAL SURFACE AND MINERALS
PRIVATE SURFACE STATE MINERALS
WETLAND ENHANCEMENT SITES
PRIVATE SURFACE FEDERAL MINERALS
STATE SURFACE AND MINERALS
STATE SURFACE FEDERAL MINERAL
36
1
12
13
24
25
36
35
2
11
14
23
26
35
34
3
10
15
22
27
34
33
4
9
16
21
28
33
32
5
8
17
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29
32
31
6
7
18
19
30
31
36
1
12
13
24
25
36
35
2
11
14
23
26
35
34
3
10
15
22
27
34

Figure I-3 Surface and mineral ownership of the area

TABLE I-1

Acreage Data for the Proposed Bull Mountains Mine No. 1

	PROJECT	DISTURBED SURFACE			SURFACE OWNERSHIP			MINERAL OWNERSHIP #		
	TOTALS	TOTAL	NEW	EXISTING	PRIVATE	STATE	FEDERAL	PRIVATE	STATE	FEDERAL
Life-of-mine area*	10,859	7,041	6,930	111	9,739	640	480	6,513	640	3,706
-Facilities	871	871	770	101	770	0	101	328	0	543
-Coal removal	7,562	6,170	6,160	10	6,613	640	309	5,047	640	1,875
-Buffer	2,426	0	0	0	2,356	0	70	1,138	0	1,288
Rail spur area**	1,165	1,165	1,150	15	1,054	111	0	N/A	N/A	N/A
-Right-of-way	1,160	1,160	1,150	10	1,049	111	0	N/A	N/A	N/A
-Road reloc.	5	5	0	5	5	0	0	N/A	N/A	N/A
Powerline easement**	63	16	6	10	56	7	0	N/A	N/A	N/A
-Upgrade	36	3	0	3	36	0	0	N/A	N/A	N/A
-Extension	27	13	6	7	20	7	0	N/A	N/A	N/A
Wetland enhancement**	22	22	16	6	22	0	0	N/A	N/A	N/A
Huntley loadout	6	6	0	6	6	0	0	6	0	0
COLUMN TOTALS	12,115	8,250	8,102	148	10,877	758	480	6,519	640	3,706

* = Includes rail spur and powerline acreages inside life-of-mine area.
** = Includes only land outside the life-of-mine area.
# = Totals refer to mineral ownership of those components pertinent to agency permitting, not of the total Project.

TABLE I-2

Scheduling Data for the Proposed Bull Mountains Mine No. 1

Activity	Time Requirement
Facility construction/development w/limited mining	2 to 3 years
Full-scale mining	30 years
Reclamation	1 year
Bond release (minimum time period for total release)	10 years
Total	43 to 44 years

TABLE I-3

Employment Data for the Proposed Bull Mountains Mine No. 1

	Total	Mining-Related			Const.
		Total	Admin.	Oper.	
Bull Mountains Mine	338	300	60	240	38
Rail Spur	26	N/A	N/A	N/A	26
Powerline Upgd/Exten	12	N/A	N/A	N/A	12
Huntley Loadout	24	12	3	9	12
Huntley Truck Haul	50	50	5	45	N/A
TOTAL EMPLOYEES:	450	362	68	294	88

C. ROLES OF STATE AND FEDERAL AGENCIES IN PROJECT APPROVAL

A number of agencies would be involved in issuance of permits or other approvals before Meridian would be allowed to begin construction and operation of the Project. The primary State and Federal authorizing actions include:

- A Montana *permit to mine coal* from Montana DSL prior to beginning any active coal-mining operations within the proposed life-of-mine area or at Huntley;
- A Montana *land use agreement* from Montana DSL prior to beginning railroad construction across State lands;
- A Federal *land use permit* from Bureau of Land Management (BLM) prior to constructing portions of the proposed surface facility complex on Federal lands; and
- A Federal *certificate of public convenience and necessity* or *an exemption from prior approval requirements* from the U.S. Interstate Commerce Commission (ICC) prior to constructing and operating a rail line that is actively involved in interstate commerce.

In addition, there are several State and Federal authorizing actions that are not necessary for Meridian to begin construction and operation activities at the mine but would be required in the future before full development of the life-of-mine area could occur. They include:

- Successive, 5-year amendments of the Montana *permit to mine coal* from Montana DSL prior to extending active coal-mining operations throughout the life-of-mine area.
- A Montana *coal lease* from Montana DSL prior to removing any State coal reserves.
- A Federal *coal lease* from BLM prior to removing any Federal coal reserves;
- A Federal *mining plan approval* from the Assistant Secretary of the Interior for Lands and Minerals Management, through the Office of Surface Management (OSM), prior to beginning active coal-mining operations in Federal coal reserves;
- A Federal *permit to mine coal* from OSM prior to beginning any active coal mining operations or rail spur construction on Federal lands within the proposed life-of-mine area.

Detailed discussions of the role these and a number of other State and Federal agencies have in Project approval are included in Appendix D.

Copies of Meridian's PAP can be reviewed by the public at: the Helena, Montana (1625 Eleventh Avenue) and Billings, Montana (Airport Industrial Park) offices of Montana DSL.

D. THE ENVIRONMENTAL IMPACT STATEMENT

As required by MEPA directives, this EIS identifies and analyzes the probable impacts to the quality of the human environment that would result should Meridian receive all necessary permits and approvals and subsequently construct and operate the Project. The EIS provides decision makers with information upon which to base a final decision that is fully informed and considers all factors relevant to the proposal. Preparation of the EIS helps assure that the proposed operation is well planned, that the major environmental impacts of the proposed action are analyzed, and that concerns of agencies, organizations, and citizens are considered

This EIS has been prepared by Montana DSL (the Agency), the responsible agency under MEPA.

Evaluation of the applicant's proposal, including its reasonable alternatives, has been conducted by interdisciplinary review with representatives from a variety of State and Federal agencies concerned with the proposal. Interdisciplinary participation has been provided by a private consultant working under the direction of Montana DSL.

This EIS is not a decision document. It is the result of a comprehensive process used to document the effects of the applicant's proposal and its reasonable alternatives. The decisions regarding the applicant's proposal will be released in a Decision Document prepared by the responsible State Official. The Montana DSL decision will relate only to Meridian's ability to comply with MSUMRA. Decisions by other jurisdictions to issue or not issue approvals related to the applicant's proposal may be aided by the disclosure of impacts available in this analysis. Other agencies may adopt the EIS or portions thereof for their own use, however, they retain the right to require further environmental information or analysis.

E. SCOPE OF THE EIS ANALYSIS

MEPA regulations define the scope of an EIS as "the range of actions, alternatives, and impacts to be considered." Agencies are initially directed to "tier" from program, policy, or plan EISs "of broad scope to those of narrower scope, to eliminate repetitive discussions" and to help the "agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe".

- Environmental issues associated with leasing and subsequent development of Federal coal in the United States have been evaluated by the U.S. Department of the Interior (DOI) in the final EIS on the Proposed Federal Coal Leasing Program (U.S. Department of the Interior 1975), the final EIS on the Federal Coal Management Program (U.S. Department of the Interior 1979), and the final EIS on the Federal Coal Management Program Supplement (U.S. Department of the Interior 1985).

- Environmental issues associated with leasing and subsequent development of Federal coal in the Powder River Basin have been evaluated by BLM in the final EIS on Powder River Basin Coal (Bureau of Land Management 1981) and the final EIS on the Economic, Social, and Cultural Supplement to the Powder River Basin Coal analysis (Bureau of Land Management 1990a).

- Environmental issues associated with preliminary coal leasing (e.g., application of the unsuitability criteria) and other land use decisions for Federal lands in the Billings Resource Area, were evaluated by BLM in the final EIS on the Billings Resource Management Plan (Bureau of Land Management 1984). Issues associated with potential leasing and/or the exchange and subsequent development of Federal coal resources in a large portion of the Bull Mountains area were evaluated by BLM in the final EIS on the Bull Mountains Exchange (Bureau of Land Management 1990b).

The Agency prepared this EIS to specifically analyze the probable site-specific and cumulative impacts to the human environment from proposed underground coal mining operations of the Project:

- Site-specific analyses address the direct and indirect impacts that would result from developing the proposed Project and reclamation operations, both on and off the specific areas targeted for disturbance, over the Project's mine life.

- The cumulative segments of the analyses address the collective impacts that would result from developing the proposed Project in conjunction with other past, present, and reasonably foreseeable future actions (see Appendix B) in the Roundup/Broadview/Billings/Huntley area.

In order to perform these analyses, certain assumptions were made about items associated with the Project. A complete list of these assumptions has been included in Chapter IV. These assumptions are for the purpose of these analyses only and are not intended to be the final projection of future activities that may or may not materialize in the area over the 44-year mine life. Specific details of the proposed Project as well as those support operations associated with the mine are included in Appendix A.

F. ISSUES RELATING TO THE PROPOSED ACTION

Numerous impact topics regarding the proposed Project were identified by the public during the scoping activities for this EIS. (See Chapter V for a complete discussion of the public participation process.) These topics were evaluated during the impact analysis portion of the EIS process to the extent that they were relevant and would have significant impact. In addition, the Agency supplemented the public's list with additional topics identified by both the EIS interdisciplinary team and Agency management. The impact topics analyzed by the Agency in Chapter IV of the EIS include:

- Air quality: Impacts from construction, operation, and reclamation activities at the mine, along the rail spur right-of-way, and at Huntley; and from the temporary truck haul to Huntley.

- Geologic resources: Impacts to stability of slopes and sandstone cliffs in the life-of-mine area.

- Topography: Impacts to the topographic character of the life-of-mine area and along the rail spur right-of-way.

- Soils: Impacts to productivity of soil materials.

- Hydrology: Impacts to water quality and quantity in the life-of-mine area and at Huntley.

- Vegetation: Impacts to productivity and stability of vegetation communities and to wetlands in and around the life-of-mine area, along the rail spur right-of-way and powerline easement, and at Huntley.

- Wildlife: Impacts to mule deer, elk, antelope, cavity- and tree-nesting birds, sharp-tailed grouse, and turkey.
- Transportation: Impacts to public safety and traffic flow from increases in worker, coal-haul truck, and coal-train traffic.
- Noise: Impacts from construction, operation, and reclamation activities at the mine, along the rail spur right-of-way, and at Huntley, and from the temporary truck haul to Huntley.
- Socioeconomics: Impacts to employment, personal income, population, public sector fiscal conditions, public services, housing, educational and health-care facilities, and social well-being.
- Recreation: Impacts to outdoor recreation opportunities in the Bull Mountains area and in Huntley.
- Land use: Impacts to land uses in the life-of-mine area, along the rail spur right-of-way, and at Huntley.
- Visual resources/aesthetics: Impacts to aesthetics in the Bull Mountains area and at Huntley.
- Cultural resources: Impacts to both known and unknown prehistoric, historic, and Native American (traditional) sites.

G. PUBLIC ISSUES CONSIDERED BUT ELIMINATED

Several additional impact topics were identified by the public during scoping activities for this EIS, but are not being addressed for a variety of reasons. A list of these topics, along with the Agency's rationale for dismissing them from the analyses, is included in Chapter V.

CHAPTER II

ALTERNATIVES

This EIS evaluates 2 prospective actions that constitute the range of reasonable alternative decisions available to the Montana Department of State Lands (Montana DSL), regarding Meridian Minerals Company's (Meridian's) plan of operation for its proposed Bull Mountains Mine No. 1 and associated support facilities (the Project).

A. DESCRIPTION OF THE ALTERNATIVES ANALYZED

1. Alternative 1: Approval of the Applicant's Proposal, With Conditions

Under this alternative, Montana DSL (the Agency) would approve the applicant's plan of operation for the proposed Project (summarized in Appendix A), subject to certain conditions identified by the Agency. These conditions (listed below) are necessary to bring the proposal into compliance with the minimum requirements of the Montana Strip and Underground Mine Reclamation Act (MSUMRA) of 1973 as amended and all other applicable State and Federal laws, such as the Endangered Species Act, National Historic Preservation Act and associated regulations, Archeological Resources Protection Act, Montana antiquities Act, American Indian Religious Freedom Act, Montana Human Skeletal Remains and Burial Site Protection Act, Montana Clean Air Act, and Federal Water Pollution Control Act as amended (i.e., the Clean Water Act). (See Appendix D for a discussion of the role that State and Federal agencies have in Project approval).

For the Project, the Agency's conditions of approval would include but not be limited to the following:

- Condition No. 1.--The operator shall submit a detailed evaluation of the life-of-mine area to the Agency identifying steep slope areas that have a high probability for disruption of subsurface deposits due to mining-related subsidence. This evaluation shall be submitted at least 2 years prior to disturbance. In coordination with the Montana State Historic Preservation Officer (SHPO), the Agency will identify additional cultural resource inventory, evaluation, and mitigation measures that may be required.

- Condition No. 2.--The operator shall mitigate anticipated mining and mining-related impacts (including those associated with rail spur development) to prehistoric, historic, or Native American (traditional) resources found to be eligible for nomination to the National Register of Historic Places. The operator shall submit a mitigation/data recovery plan to the Agency for approval, in coordination with Montana SHPO, at least 2 years prior to disturbance. The approved mitigation/data recovery plan must be successfully completed prior to disturbing the site(s).

- Condition No. 3.--If, during mining and reclamation operations, previously undiscovered prehistoric, historic, or traditional resources are discovered, the operator shall ensure that the resources are not disturbed and shall notify the Agency of their nature and location. The Operator shall take such necessary actions as are required by the Agency to protect the resource, in coordination with Montana SHPO.

- Condition No. 4.--Meridian shall obtain a Federal permit prior to use of the Federal portions of the Waste Disposal Area (WDA).

2. Alternative 2: Disapproval of the Applicant's Proposal

Under this alternative, Montana DSL would disapprove the applicant's plan of operation for the proposed Project (summarized in Appendix A) because (1) it did not meet the requirements of all applicable State laws, or (2) the proposal imposed, or had the potential to impose, unacceptable impacts on the human environment.

For the purposes of this EIS, the "no action" alternative is considered to be equivalent to disapproval of the applicant's proposal.

B. OTHER ALTERNATIVES CONSIDERED

The following alternatives were considered by the Agency during the preparation of this EIS but were eliminated from detailed analysis:

- The alternative to approve the applicant's proposal without additional conditions was evaluated and determined to be inappropriate. MSUMRA requires Montana DSL to approve, conditionally approve, or disapprove the permit application submitted by Meridian. However, if additional conditions are necessary for the application to be acceptable under the applicable regulations, approving it without those conditions would not be a reasonable alternative.

- Alternatives to the development of coal resources are inappropriate in the present analysis because Meridian owns or holds active leases for the majority of the coal resources at the Bull Mountains Mine No. 1 mine site. Therefore, these alternatives are not analyzed further.

- Alternatives that would require the use of room-and-pillar mining methods throughout the mine, rather than the proposed combination of room-and-pillar and longwall methods, were determined to be unreasonable due to the increased costs and decreased levels of coal recovery that would result. Environmental impacts associated with room-and-pillar methods were determined to be comparable to those associated with longwall methods over the long term. (See Appendix C for a discussion of the methods and equipment associated with the underground mining of coal.)

- Alternatives that would require the use of "backstowing" techniques to dispose of the waste in mined-out portions of the mine, rather than develop a head-of-hollow fill for mine waste disposal (the proposed WDA) were evaluated. They were eliminated from further analysis because although theoretically possible, backstowing would be economically impractical and generally incompatible with the planned caving and subsidence associated with the longwall method of coal removal. (See Appendix C for a discussion of the methods and equipment associated with the underground mining of coal.)

- Three alternatives to the applicant's proposed location for the 33-mile rail spur were evaluated by the Agency. Two alternatives would rebuild portions of the old Milwaukee Railroad right-of-way between Roundup and the Burlington Northern mainline near Cushman -- 1 would involve new construction to the north along Rehder and Halfbreed creeks to Riverside and the Milwaukee right-of-way; the other would involve new construction overland to the west to Harper Coulee, northwest to Goulding Creek, and then north to the Milwaukee right-of-way. One alternative would involve new construction overland to the southeast near Shepherd and then south to the mainline east of Huntley and south of the Yellowstone River.

  These alternatives were determined not to be reasonable for a variety of reasons, including the increased cost of construction, the potential for increased impacts to sensitive areas with wetland and wildlife habitat values, and increases in engineering complexity. All involve a longer rail spur, increasing the levels of surface disturbance, the amount and cost of construction material, the amount and cost of right-of-way, and the number of landowners affected. Details of the Agency's evaluation of these routes is available for review in Montana DSL files in Helena.

- Two routing adjustments were made for portions of Meridian's preferred proposal for the 33-mile rail spur. These adjustments were evaluated and determined to be unreasonable due to landowner concern with the disruption of farming and ranching operations and the need to avoid sensitive wetlands and farmlands as much as possible.

- A total of 9 alternatives to temporary use of the existing coal loadout facility at Huntley were evaluated by the Agency. The 9 sites were located within 4 general areas: the Broadview/Comanche/Acton area, Lavina/Cushman/Belmont area, Roundup area, and Billings/Huntley area (specifically, in the Billings/Huntley area, the Coors Warehouse property east of Huntley and an area near the intersection of Highway 312 and the Burlington Northern mainline west of Billings).

  The increased costs and environmental impacts that would be associated with the required upgrade of County and State roadways, as well as the purchase and construction of a new short-term facility, were determined to be excessive and unreasonable when compared to the use of the existing paved roadways and loadout facilities at Huntley. Details of the Agency evaluation of these sites is available for review in Montana DSL files in Helena.

- Alternative methods of permanent coal transportation from the mine, including the use of either conveyors or trucks to eliminate the need for rail spur construction and operation were evaluated. The Agency determined both methods to be unreasonable due to concern over cost, maintenance, and environmental degradation issues. Both methods would require the construction and use of a second, large, coal-handling facility over the 33-year period of coal removal from the proposed mine, complicating site selection problems already associated with the temporary truck haul and loadout.

  The considerable costs of trucking would not only make the economics of mine development questionable, but would require local communities to accommodate the large amount of haul-truck traffic that would be required at full production for the entire mine life. The conveyor, while eliminating noise and nuisance problems associated with both trains and trucks, would encounter problems with engineering complexity and system reliability as well as all of the route selection and environmental protection problems of the rail spur proposal.

C. COMPARISON OF ALTERNATIVES

Table IV-5 provides a complete listing, by discipline, of all impact comparisons from the Chapter IV analysis. Table II-1 provides a selected listing of those comparisons that include more important impacts. Summaries of the comparisons follow:

- Alternative 1 (approval of the applicant's proposal, with conditions): If the Agency chooses this alternative, major and significant impacts could occur to certain aspects of hydrology, vegetation, transportation, and visual/aesthetic resources.

  Certain aspects of transportation, socioeconomic, and cultural resources may sustain minor to moderate impacts that have the potential to become significant.

  Certain aspects of hydrology, topography, soils, vegetation, land use, visual/aesthetics, and cultural resources could be irretrievably lost. Certain aspects of hydrology, vegetation, wildlife, and land use resources could be irreversibly and irretrievably lost.

- Alternative 2 (disapproval of the applicant's proposal): If the Agency chooses this alternative, the existing levels of impacts to the resources of the area would continue at existing levels. Incremental impacts resulting from mining and development of the Project would not occur.

TABLE II-1
Summary of Important Impacts by Alternative for Bull Mountains Mine No. 1

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
TOPOGRAPHY Impacts to the topography of surface facility complex.	Moderate to major over short term and minor to negligible over long term. Irretrievable loss of topographical diversity due to WDA.	Negligible impacts.
SOILS Impacts to soil productivity in areas of mining-related surface disturbance.	Moderate to major over short term and minor over long term. Productivity losses under track ballast would be irretrievable.	Negligible impacts.
HYDROLOGY Impacts to ground and surface water supplies in and around the life-of-mine area from mining and mining-related subsidence.	If mitigation failed, possible irreversible and irretrievable loss of some springs and intermittent stream reaches.	Negligible impacts.
VEGETATION Impacts to wetlands in/around life-of-mine area.	If mitigation failed, possible irreversible and irretrievable loss in the area of failed mitigation.	Minor impacts
Impacts to vegetative productivity and stability along powerline and rail corridors.	Moderate to major over short term depending on revegetation success and weed invasion and negligible over long term. Irretrievable loss of productivity until reclamation succeeded.	Negligible to minor impacts.
Impacts to vegetative productivity and stability within the surface facility complex and Huntley loadout.	Moderate over short term and negligible over long term. Irretrievable loss of productivity until reclamation succeeded.	Negligible impacts.
WILDLIFE Impacts to wildlife productivity within the life-of-mine area from mining-related subsidence.	If mitigation failed, an irreversible and irretrievable loss of aquatic animal habitat in the area of failed mitigation.	Negligible impacts.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
TRANSPORTATION		
Impacts to traffic flow and public safety along public highways from mining-related traffic.	Moderate and potentially significant in first 2 to 3 years. Negligible over long term.	Minor impacts.
Impacts to the integrity/stability of County and State roads from coal trucks.	Major and significant over short term and minor to moderate over long term.	Minor impacts.
SOCIOECONOMICS		
Impacts to educational facilities.	Moderate and potentially significant over short term and negligible over long term.	Minor impacts.
Impacts to social well-being in Bull Mountains area.	Moderate and potentially significant over short term and minor long term.	Moderately negative impacts for those favoring the Project and moderately positive impacts for those opposing it.
Impacts to social well-being in the Huntley area.	Moderate and potentially significant over short term and moderate positive over long term.	Moderately negative impacts for those favoring the Project and moderately positive impacts for those opposing it.
Impacts to public sector fiscal conditions.	Minor and beneficial impact over short term and minor and negative over long term.	Negligible impacts. Foregone benefits moderate to major.
LAND USE		
Impacts to land use along the rail spur from construction and train traffic.	Moderate over short and long terms. Loss of agricultural productivity and other development would be irretrievable.	Negligible impacts.
VISUAL RESOURCE/AESTHETICS		
Impacts to visuals/aesthetics in the Bull Mountains area.	Minor to moderate over short and long terms. WDA would constitute an irretrievable commitment of visual/aesthetic resources.	Negligible impacts.
Impacts to visual/aesthetics in the Bull Mountains area from the rail spur.	Minor to moderate over short and long terms. Cuts-and-fills and structures would constitute an irretrievable commitment of visual/aesthetic resources.	Negligible impacts.
Impacts to visual/aesthetics from Huntley loadout.	Major and significant over short term and negligible over long term.	Negligible to moderate.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
CULTURAL RESOURCES		
Impacts to prehistoric and historic resources.	Impacts minor and permanent. Data recovery could be beneficial.	Negligible impacts.
Impacts to Native American resources.	Impacts minor, permanent, and potentially significant. Several potentially sensitive areas may be irretrievably disturbed.	Negligible impacts.
Impacts to undiscovered prehistoric, historic, and Native American resources.	Impacts moderate, permanent, and potentially significant and some may be irretrievable.	Negligible impacts.

CHAPTER III

DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. CLIMATE AND AIR QUALITY

1. Regional Climate

Climate in southcentral Montana is classified as Middle Latitude Steppe. This semiarid region is characterized by low rainfall, low humidity, clear skies, and relatively large annual and diurnal temperature ranges.

Average annual precipitation for the region is about 14 inches with about one-third falling during May and June. The period of least precipitation is November through February. Heavy snows, from 6 inches to 1 foot, are not uncommon during the winter. Snow seldom accumulates to great depths because of thawing from strong west-to-southwest downslope winds called Chinooks. Thunderstorms occur on about 30 days during a typical year, mainly from May through September. These storms are frequently accompanied by strong, gusty winds and occasional hail. Destructive hailstorms are infrequent. Upslope fog and low clouds, accompanied by east and northeast winds, are common during the colder two-thirds of the year with an occasional occurrence during the warmest months. A summary of climatological data, including means and extremes, for Billings, Montana is presented in Table E-1, Appendix E. These data are representative for the region.

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, wind speed, and wind direction. Mixing height is the height above ground within which rising warm air from the surface will mix by convection. The degree to which pollutants are diluted in this mixed layer is determined by local atmospheric conditions, terrain configuration, and source location. Mixing heights vary diurnally and with season. Mixing is strongest during the summer afternoons and weakest during the winter mornings (see Table III-1).

Wind speed has an important effect on area ventilation and the dilution of pollutant concentrations from individual sources. Light winds, in conjunction with large source emissions, may lead to an accumulation of pollutants that can move to downwind areas. With the average 8-to-12 mile per hour (MPH), prevailing westerly wind in central Montana, downwind is usually to the east.

TABLE III-1

Diurnal and Seasonal Variation of Mixing Heights (Feet) Over Southcentral Montana

Season	Morning	Afternoon
Winter	800-1,300	2,600-3,280
Spring	1,300-1,800	7,900-8,200
Summer	980-1,300	9,200-9,800
Autumn	980-1,300	5,250-5,900
Annual	1,150-1,300	6,500-6,890

Source: Holzworth (1972)

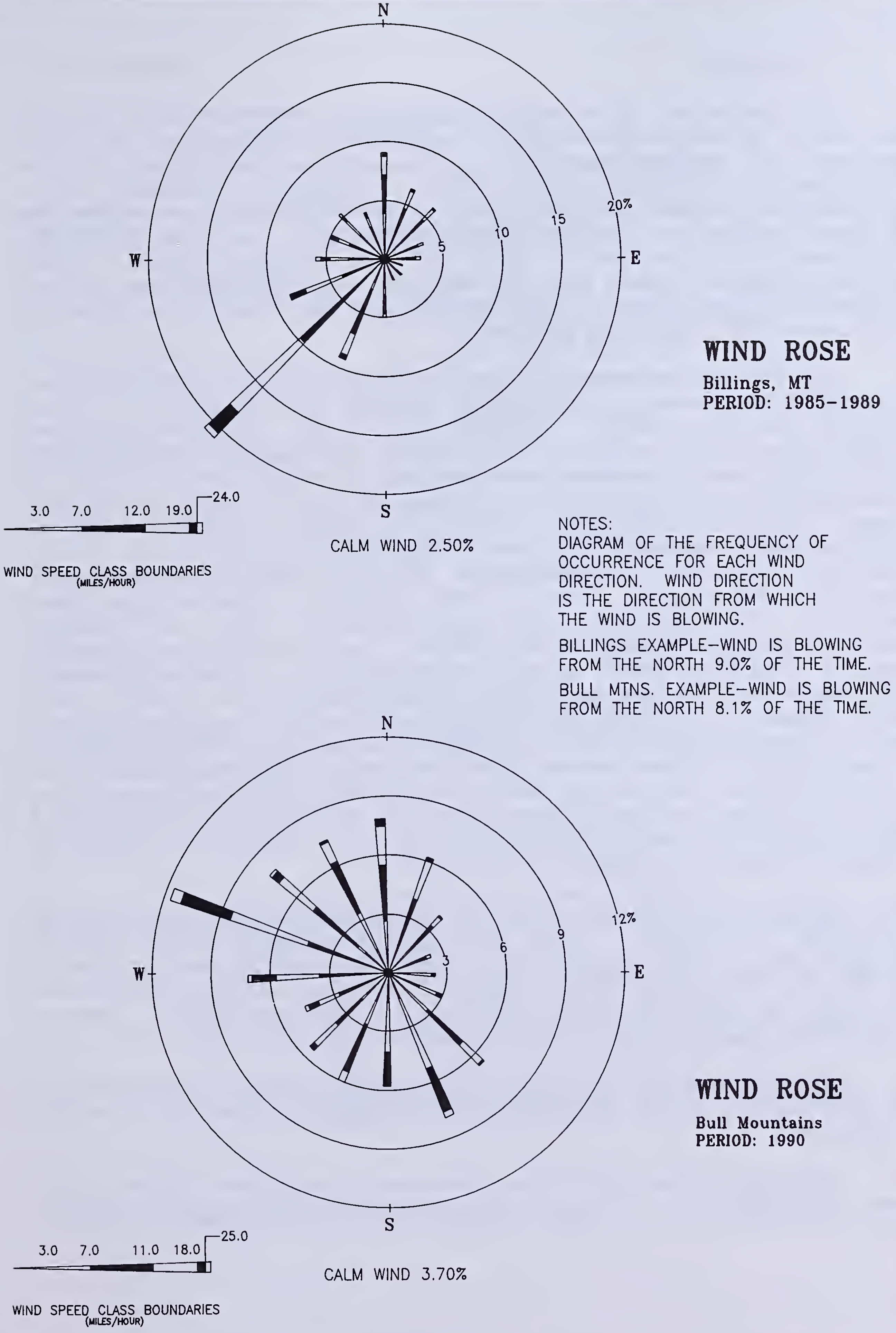
2. Local Winds

Because Billings and Huntley are located in the same southwest-to northeast-oriented river valley, they have similar prevailing wind conditions. Therefore, data from Billings may be used for Huntley. The annual wind rose for Billings, shown in Figure III-1, indicates a prevailing wind from the southwest.

The 1990 wind rose for the Bull Mountains area (see Figure III-1), indicates that the wind directions are more uniformly distributed with the prevailing wind from the west-northwest.

3. Air Quality

Air quality is described by the concentration of various pollutants and their interactions in the atmosphere. Pollution effects on receptors establish the extent to which that quality is degraded. Measurement of pollutants is expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Both long-term climatic factors and short-term weather fluctuations are considered part of the air quality resource because they control dispersion and affect concentrations. Physical effects of air quality depend on the characteristics of the receptors and the type, amount, and duration of exposure. Air quality standards specify upper limits of pollutant concentrations and durations of exposure. Air pollutant concentrations within the standards are generally not considered to be detrimental to public health and welfare.



NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING.

BILLINGS EXAMPLE–WIND IS BLOWING FROM THE NORTH 9.0% OF THE TIME.

BULL MTNS. EXAMPLE–WIND IS BLOWING FROM THE NORTH 8.1% OF THE TIME.

Figure III-1 Wind roses, Billings, Montana, and Bull Mountains, Montana

The relative importance of pollutant concentrations can be determined by comparison with an appropriate national and/or state ambient air quality standard. An area is designated by the Environmental Protection Agency (EPA) as being in attainment for a pollutant if ambient concentrations of that pollutant are below the National Ambient Air Quality Standards (NAAQS). An area is not in attainment if violations of NAAQS for that pollutant occur. Areas where insufficient data are available to make an attainment status designation are listed as unclassified and are treated as being in attainment for regulatory purposes.

The Federal Prevention of Significant Deterioration (PSD) program, enacted by Congress, is implemented in large part through the use of "increments" and area classification that effectively define "significant deterioration" for individual pollutants. The Clean Air Act's (CAA) area classification scheme for PSD establishes 3 classes of geographic areas and applies increments of different stringency to each class. The CAA established Class I for areas of special national concern where the need to prevent significant deterioration in air quality is greatest. Consequently, the most restrictive increments apply in Class I areas. Class I areas include all international parks as well as national parks, national wilderness areas, and national memorial parks exceeding certain sizes. Less restrictive increments apply in areas designated as Class II or Class III. Class II areas are all PSD areas that are designated as in attainment or unclassifiable with respect to the NAAQS and are not classified in the CAA as Class I. Most of southcentral Montana, including the proposed Project area, is classified as a Class II area under the Federal PSD regulations. The Class III area designation would permit more deterioration in air quality in specific areas designated by the states for higher levels of industrial development and emissions growth. There are as yet no Class III areas in Montana.

Montana air quality standards have been established for the following pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter smaller than 10 micrometers in diameter (PM_{10}), lead (Pb), hydrogen sulfide (H_2S), Foliar fluoride, settled particulate (dust-fall), and visibility. Montana ambient air quality standards are presented in Table III-2.

All of the areas involved in the proposed Project are considered in attainment of all the National and Montana ambient air quality standards.

The PSD maximum allowable increases in pollutant concentration over the baseline in a Class II area are as follows (40 CFR 52.21):

TABLE III-2

Montana Ambient Air Quality Standards

Pollutant	Montana Standard
Particulate Matter (PM$_{10}$)	50 $\mu g/m^3$ expected annual average 150 $\mu g/m^3$ expected 24-hr average*
Sulfur Dioxide	0.02 ppm annual average 0.10 ppm 24-hr average* 0.50 ppm 1-hr average**
Carbon Monoxide	9 ppm 8-hr average* 23 ppm hourly average**
Nitrogen Dioxide	0.05 ppm annual average 0.30 ppm hourly average*
Photochemical Oxidants (ozone)	0.10 hourly average*
Lead	1.5 $\mu g/m^3$ 90-day average
Foliar Fluoride	35 $\mu g/g$ grazing season average 50 $\mu g/g$ monthly average
Hydrogen Sulfide	0.05 ppm hourly average*
Settled Particulate (Dust-fall)	10 gm/m^2 30-day average
Visibility	Particle scattering coefficient of 3x10^5 per meter annual average***

Notes: PM$_{10}$ = particulate matter with an aerodynamic diameter less than 10 microns.
$\mu g/m^3$ = micrograms pollutant per cubic meter of sampled air.
ppm = parts pollutant per million parts of sampled air.
* = Not to be exceeded more than once per year.
** = Not to be exceeded more than 18 times per year.
*** = Applies to PSD mandatory Class I areas.

Source: Montana Air Quality Bureau, 1991.

Pollutant	Maximum Allowable Increase ($\mu g/m^3$)
• Particulate Matter (TSP)	
annual geometric mean	19
24-hour maximum	37
• Sulfur Dioxide	
Annual arithmetic mean	20
24-hour maximum	91
3-hour maximum	512
• Nitrogen Dioxide	
Annual arithmetic mean	25

Baseline PSD concentrations have not been established for the proposed Project area, which is within the Billings Intrastate Air Quality control Region (AQCR Number 140) (CFR 40:81.88). Primary existing sources of air pollution in the area are as follows:

- Asphalt plants (particulates);
- Gravel crushers (particulates);
- Home heating devices or equipment (particulates, CO);
- Motor vehicles (CO, NO_x, hydrocarbons, re-entrained particulates);
- Agricultural activities (particulates);
- Wind erosion (particulates);
- Open burning (particulates); and
- Mining operations (particulates).

In addition, Yellowstone County has the following pollution sources:

- Three oil refineries (SO_x, H_2S, NO_x, hydrocarbons, particulates)
- Coal-fired power plant (SO_2, NO_x, particulates)
- Sulfur plant (SO_x, SO_3)
- Grain processing (particulates)
- Sugar beet processing plant

PM_{10} monitoring data, obtained during 1989 and 1990 near the proposed mine site, show the maximum 24-hour concentration was 53 $\mu g/m^3$. The annual average concentration for this area was approximately 9 $\mu g/m^3$. In the Huntley area, the maximum 24-hour PM_{10} concentration was about 41 $\mu g/m^3$ with an annual average of about 14 $\mu g/m^3$.

B. GEOLOGY

The Bull Mountains lie within that portion of the Bull Mountains basin defined by sedimentary rocks of the Fort Union Formation deposited during the later portion of the tertiary period. The sandstones, siltstones, shales, and coal beds of the Fort Union are divided between the Tullock member, the Lebo Shale, and the upper member, the Tongue River (see Figure III-2). It is the Tongue River member that contains the coal seam of commercial interest for the proposed underground mine.

Stratigraphically, the highly dissected terrain, underlain by discontinuous sandstones, siltstones, and shales and relatively thin coal seams, is found in the Bull Mountains area and throughout eastern Montana. At the surface, exposed sandstone cliffs and steep slopes in portions of the life-of-mine area naturally weather and erode, resulting in toppling of rock and sloughing of surface materials on slopes. Structurally, the proposed life-of-mine area is underlain by a northwest-plunging syncline, or fold in rock layers where the layers dip (1 to 2 degrees) inward towards an axis.

1. Mineral Resources

The Mammoth Coal seam is of primary interest for the proposed mine. This seam is found within the Tongue River member of the Fort Union Formation. The Mammoth Coal ranges from 8 to 15 feet thick, thinnest in the west and thickening towards the east. Locally, some outcrops have burned as a result of natural causes, baking overlying sandstones and shales into a rock called clinker. Clinker beds up to 90 feet thick characterize higher elevations in portions of the area. The Mammoth Coal reserves contain a low amount of ash that averages 10.2 percent; a low 0.87 percent of sulfur; a high 42.12 percent of fixed carbon; a low 17.65 percent of moisture; an average 29.68 percent of volatile matter; and a moderate 9640 BTU/lb (British Thermal Units, the energy contained in 1 pound of coal). About 218 million tons of in-place coal reserves have been identified within the proposed life-of-mine area in 14 different seams, including the Mammoth.

Sand and gravel resources can be found throughout Musselshell and Yellowstone counties. Oil and gas resources may be present in the area. While there has been exploration for oil and gas in the past, there are no known plans to develop those resources at this time.

2. Paleontological Resources

Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geological age. They include casts, molds, and trace fossils such as burrows or tracks. Fossil localities typically include surface outcrops, areas where subsurface deposits are exposed, and special environments favoring

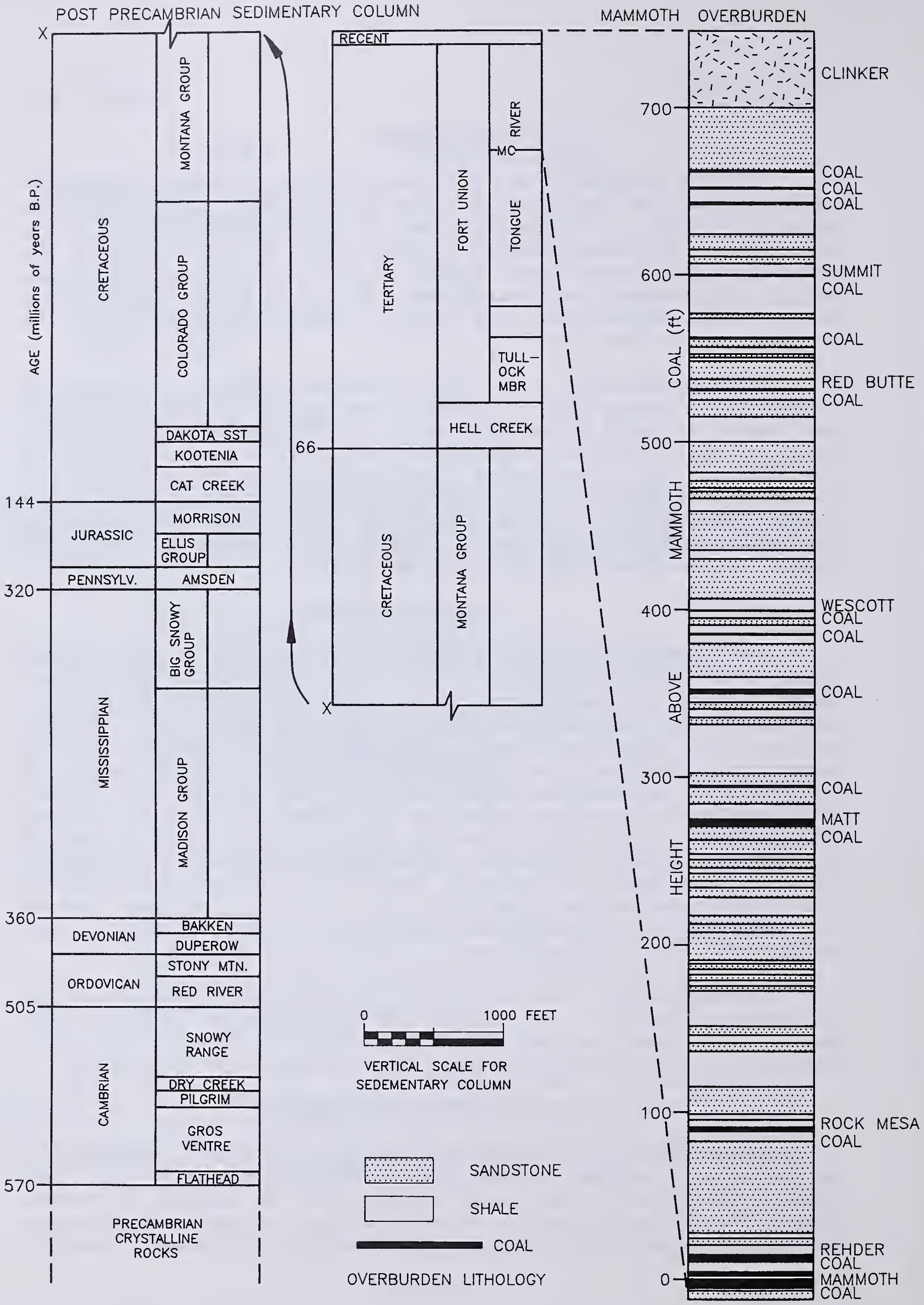

POST PRECAMBRIAN SEDIMENTARY COLUMN
X
AGE (millions of years B.P.)
CRETACEOUS
MONTANA GROUP
COLORADO GROUP
DAKOTA SST
KOOTENIA
CAT CREEK
144
JURASSIC
MORRISON
ELLIS GROUP
320
PENNSYLV.
AMSDEN
MISSISSIPPIAN
BIG SNOWY GROUP
MADISON GROUP
360
DEVONIAN
BAKKEN
DUPEROW
ORDOVICAN
STONY MTN.
RED RIVER
505
CAMBRIAN
SNOWY RANGE
DRY CREEK
PILGRIM
GROS VENTRE
570
FLATHEAD
PRECAMBRIAN CRYSTALLINE ROCKS
RECENT
TERTIARY
FORT UNION
RIVER
MC
TONGUE
TULL-OCK MBR
HELL CREEK
66
CRETACEOUS
MONTANA GROUP
X
0
1000 FEET
VERTICAL SCALE FOR SEDEMENTARY COLUMN
SANDSTONE
SHALE
COAL
OVERBURDEN LITHOLOGY
MAMMOTH OVERBURDEN
HEIGHT ABOVE MAMMOTH COAL (ft)
700
600
500
400
300
200
100
0
CLINKER
COAL
COAL
COAL
SUMMIT COAL
COAL
RED BUTTE COAL
WESCOTT COAL
COAL
COAL
COAL
MATT COAL
ROCK MESA COAL
REHDER COAL
MAMMOTH COAL

Figure III-2 Stratigraphy of the Bull Mountains

preservation, such as caves, peat bogs, and tar pits. Paleontological resources are important mainly for their potential to provide scientific information on the evolutionary history of plants and animals and their environments.

Shales and sandstones of the Fort Union Formation are known to contain abundant plant fossils including evidence of fern, moss, cycad, conifer, palm, water lily, birch, hazel, hickory, viburnum, and various angiosperms (Brown 1952; Perry 1975; Spindel 1975; Reynolds and Robertson 1978; Windmayer 1977). The animal fossils are much more limited and include turtles, mollusks, and insects.

Paleontological materials associated with the Fort Union Formation are not considered to contain high research potential (National Research Council 1987). The Fort Union Formation in the Bull Mountains area could be expected to contain some plant remains and mollusks but no paleontological localities have been documented.

C. TOPOGRAPHY

While the proposed life-of-mine area lies in mountainous terrain, the Huntley loadout is located in a relatively flat alluvial area adjacent to the Yellowstone River. The proposed rail spur corridor is located in mountainous terrain as it approaches the life-of-mine area but shifts to flat-to-rolling agricultural land as it terminates south of Broadview.

Elevations in the proposed life-of-mine area range between 3,700 and 4,750 feet above mean sea level. The average elevation in the vicinity of the proposed surface facility complex is about 3,900 feet above mean sea level. Topography of the area is characterized by gently sloping valleys bounded by ridges capped by frequent sandstone and clinker mesas. Surface slopes can reach as high as 15 percent in the area proposed for surface facilities and up to 45 percent in the vicinity of Dunn Mountain and other mesas and ridges.

Elevations in the vicinity of the proposed rail spur corridor range between about 3,700 and 4,200 feet above mean sea level. Higher elevations are experienced in the eastern end, about 5 miles from the proposed surface facility complex. Lowest elevations are encountered at the western end of the corridor, south of Broadview. Surface slopes in the vicinity of the corridor are similar to those in the life-of-mine area until the corridor exits the foothills near the Musselshell-Yellowstone county line. From this area through its southwesterly extent, the proposed corridor is characterized by flat-to-rolling agricultural land.

The powerline corridor, proposed for upgrade activities, follows Rehder and Halfbreed Creek drainages (see Figure III-3) and U.S.

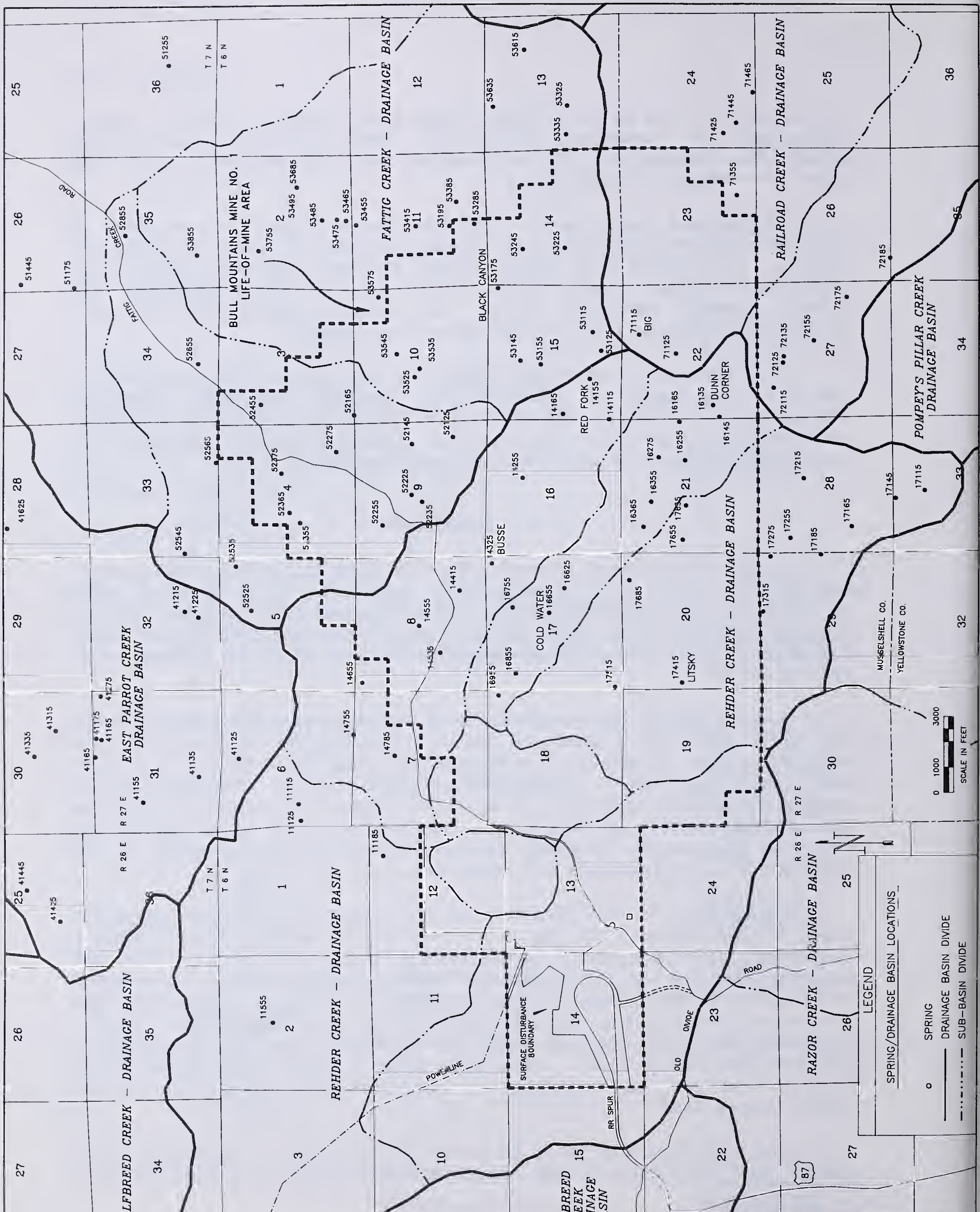

BULL MOUNTAINS MINE NO. 1
LIFE-OF-MINE AREA
FATTIG CREEK - DRAINAGE BASIN
RAILROAD CREEK - DRAINAGE BASIN
POMPEY'S PILLAR CREEK DRAINAGE BASIN
EAST PARROT CREEK DRAINAGE BASIN
REHDER CREEK - DRAINAGE BASIN
HALFBREED CREEK - DRAINAGE BASIN
HALFBREED CREEK DRAINAGE BASIN
RAZOR CREEK - DRAINAGE BASIN
SURFACE DISTURBANCE BOUNDARY
BLACK CANYON
BIG
RED FORK
DUNN CORNER
BUSSE
COLD WATER
LITSKY
FATTIG CREEK
ROAD
OLD DIVIDE ROAD
RR SPUR
POWERLINE
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
87
0 1000 3000
SCALE IN FEET
LEGEND
SPRING/DRAINAGE BASIN LOCATIONS
SPRING
DRAINAGE BASIN DIVIDE
SUB-BASIN DIVIDE

Figure III-3 Spring/drainage basin locations

Highway 87 in a northerly direction towards Roundup. Powerline corridor elevations range from about 3,900 feet above mean sea level at its upper reaches, near the proposed surface facility complex, to about 3,300 feet in the vicinity of the Musselshell River. Grass-covered side drainages between hills provide a rolling character to the area.

The 6-acre Huntley loadout site is located on a flat alluvial area in Huntley, adjacent to the Burlington Northern railroad tracks. The area is adjacent to a grain elevator and has had previous surface disturbance.

D. SOILS

Detailed soils information has been compiled for the life-of-mine area, railroad and powerline corridors, and Huntley loadout. Mining and ancillary facilities would be located in Musselshell and Yellowstone counties and, while there is a published soils survey for Yellowstone County (Meshnick 1972), a survey has not been published for Musselshell County. Individual surveys were conducted for all proposed facilities and other mine-related disturbance areas in Musselshell County (Soil Conservation Service 1970-1989).

Soils in the planned surface disturbance areas of the proposed life-of-mine area are predominantly loams, silty loams, or sandy loams, with an occasional increase in fines to silty clay. Soils are shallower along upper slopes and fans, and deeper on lower terraces and drainage bottoms. The relatively shallow, upland Cabbart soils dominate the life-of-mine area with the Cabbart loam dominating the surface facility complex. These soils are well drained, have limited available water capacity and are easily eroded. Sandstone outcrops and clinker characterize plateaus and rims.

The proposed 33-mile railroad corridor is located in both Musselshell and Yellowstone counties. Thirteen mapping units characterize the corridor in Musselshell County with loams, clay loams, and silty clay loams being predominant. Mineral and salt deposits, steep slopes, and rock outcroppings that are frequent in the foothills become fewer as characteristics are tracked from the mine site towards the southwest, and the Yellowstone County line. From the Musselshell-Yellowstone county line, southwesterly to the railroad corridor's junction with the mainline south of Broadview, clays, silty clays, and clay loams become more predominant. Throughout the railroad corridor, soils have high erosion potential and range widely in their depth. In the vicinity of swales and basins, the clayey and wet soils pose the greatest construction limitations (e.g., high water tables at or within 36 inches of surface, erosion risk, high frost-action potential, and shrink-swell potential).

The 17-mile powerline corridor is located entirely within Musselshell County. Soils along the corridor vary with geology and topographic features, with shallow loams and rock outcrop inclusions on the slopes and rolling hills and deeper loams in valleys along drainages. The loams are generally well drained and have the potential to erode. Wet areas and ponds are encountered along the corridor within the loam soils. These areas appear to be human-made or -influenced and as such, soils features may not be consistent with natural soils in the area.

The Huntley loadout site is characterized by loam and silty clay loam soils. These are moderately deep, well-drained soils formed on alluvial river terraces. They have a high erodibility potential, good water-holding capacity, and are good topsoils.

There have been no soils of prime farmland quality identified in the areas proposed for Project activities.

E. HYDROLOGY

1. Surface Water Resources

General surface drainage from the Bull Mountains area is north toward the Musselshell River and south toward the Yellowstone River.

There are no perennial stream systems present within or immediately adjacent to the proposed life-of-mine area. The nearest perennial stream is the lower reach of Halfbreed Creek near its confluence with the Musselshell River, 18 miles to the north. Numerous ephemeral drainage basins that range in size from 10 to 10,000 acres discharge surface runoff. These ephemeral channels flow only in response to precipitation, however there are perennial ponds and stream reaches created by flow from springs. Northerly drainage occurs through Rehder and Fattig creeks, while Pompey's Pillar and Railroad creeks provide drainage to the southeast (see Figure III-3).

The proposed corridor for the rail spur would neither cross nor be adjacent to any perennial stream system. Generally, the corridor is proposed for high areas where intersecting ephemeral channels drain small areas. The upper Goulding and Dean creeks provide northerly drainage while the upper Razor Creek system provides the only major drainage to the southeast along the proposed corridor. The powerline corridor proposed for upgrade activities follows the Rehder and Halfbreed Creek drainages from the proposed life-of-mine area to the Musselshell River. The corridor crosses the perennial Musselshell River and continues into Roundup to a substation. The Huntley loadout site is currently located in a disturbed area where surface drainage is directed to a lined sediment pond.

No designated alluvial valley floors (AVFs) are present within the proposed life-of-mine area or in areas proposed for associated activities. However, there are potential alluvial valley floors adjacent to the proposed life-of-mine area. By applying the draft "Alluvial Valley Floor Identification and Study Guidelines" (U.S. Department of the Interior 1983) portions of Rehder, Fattig, Railroad, East Parrot, West Parrot, Halfbreed, and Pompey's Pillar creeks have been identified as potential AVFs.

2. Ground Water Resources

In general, ground water flow in the Bull Mountains area is to the northwest, consistent with the plunging syncline (see Geology). Flow volumes are more dependable in deeper aquifers and less dependable in more shallow aquifers of the Tongue River formation. These shallow aquifers in which wells and springs tend to be confined, are highly dependent on precipitation, infiltration, and percolation through various coal seams and sandstones. The capability of aquifers to transmit water (permeability) ranges from thousandths of feet to multiple-unit feet per day which makes flow rates highly variable. There are 4 wells currently installed in the area of the proposed surface facility complex. At depths of about 200 feet, they are planned to supply potable water to proposed mine operations (see Ancillary Facilities, Appendix A).

Three aquifer-bearing geologic formations overlie the deep impermeable shales of the Bull Mountains Basin. From deep to shallow they are: the Lower Hell Creek, Tullock, and Tongue River formations (see Figure III-2). In addition, alluvial sands and gravels serve as productive aquifers where they are thick and well developed. Deep carbonate rocks of the Madison Group are a major but little-used aquifer.

In the vicinity of the proposed mine, the aquifer of the Lower Hell Creek formation is about 400 feet thick. Yields are highly variable and range between 5 and 200 gallons per minute (gpm). The aquifer of the Tullock formation commonly produces 15 gpm. Aquifers of the Tongue River formation include sandstones that have produced as much as 160 gpm. In the Bull Mountains area, yields tend towards 10 to 30 gpm. While the coal seams of the Tongue River member are potentially good aquifers, the Mammoth coal seam in the vicinity of the proposed mine is not a high-yielding aquifer. Alluvial aquifers in the vicinity of the proposed mine do not consistently yield adequate supplies of water as they are thin and discontinuous. The alluvial gravels in the vicinity of the Huntley loadout are sands and gravels mixed with cobbles that yield supplies of water adequate for most uses.

One hundred-thirty springs have been located in and around the proposed life-of-mine area (see Figure III-3 and Table E-2, Appendix E). Some of the springs have been enhanced through tank and pond

TABLE III-3
Relative Importance of Springs in the Life-of-Mine Area

SPRING NAME/NUMBER	HYDROLOGY[1]	AQUATICS[2]	VEGETATION[3]	LAND USE[4]	WILDLIFE[5]	CUMULATIVE[6]	RELATIVE SCORE[7]
Red Fork 14115	4	2	1	3	2	12	2
14155	3	2	2	2	3	12	2
14165	4	2	2	2	3	13	3
14255	4	3	4	3	4	18	4
Busse 14325	4	4	4	4	4	20	4
14415	3	3	3	3	3	15	3
14535	2	1	2	1	1	7	1
14555	2	2	1	3	3	11	2
Dunn Corner 16135	4	2	1	2	2	11	2
16145	4	1	1	1	1	8	2
16165	3	1	4	2	3	13	3
16255	4	1	1	1	2	9	2
16275	3	2	2	2	3	12	2
16355	4	3	2	2	3	14	3
16365	4	3	2	2	3	14	3
16625	3	1	2	1	1	8	2
Cold Water 16655	4	4	4	4	4	20	4
16755	3	1	1	2	1	8	2
16855	2	1	1	1	1	6	1
16955	3	1	2	2	1	9	2
Litsky 17415	4	4	4	4	4	20	4
17515	3	3	3	3	1	13	3
17635	3	2	1	3	1	10	2
17655	2	2	1	2	1	8	2
17685	4	3	2	3	3	15	3

SPRING NAME/NUMBER	HYDROLOGY[1]	AQUATICS[2]	VEGETATION[3]	LAND USE[4]	WILDLIFE[5]	CUMULATIVE[6]	RELATIVE SCORE[7]
52125	3	2	2	3	3	13	3
52145	2	2	2	3	3	12	2
52165	3	2	3	3	4	15	3
52225	3	1	1	2	2	9	2
52235	2	1	1	2	2	8	2
52255	2	1	1	2	1	7	1
52275	2	2	2	2	4	12	2
52355	2	1	2	2	2	9	2
52365	1	1	1	1	2	6	1
52375	2	2	2	3	3	12	2
Dugout 52455	3	2	2	3	3	13	3
53115	4	1	1	2	1	9	2
53125	3	1	1	2	1	8	2
53145	3	1	2	2	2	10	2
53155	3	1	2	1	2	9	2
Black Canyon 53175	3	4	2	4	4	17	3
53225	2	1	1	2	2	8	2
53245	3	2	1	2	4	12	2
53285	3	3	2	3	3	14	3
53525	2	1	2	2	2	9	2
53535	2	1	2	2	3	10	2
53545	3	1	3	2	3	12	2
Big 71115	4	2	1	3	1	11	2
71125	3	2	1	2	1	9	2

[1] See Table E-3-7, Appendix E

[2] See Table E-3-7, Appendix E

[3] See Table E-3-7, Appendix E

[4] See Table E-3-7, Appendix E

[5] See Table E-3-7, Appendix E

[6] **CUMULATIVE SCORE ÷ 5 = RELATIVE SCORE**

[7] 1 is lowest score, 4 is highest

installation and many discharge to nearby drainages. Springs vary widely in quantity of flow, and period or season of flow. The springs supply water for livestock and wildlife use and support vegetation and aquatic communities of varying size and composition. Fourteen of the 49 springs located within the proposed life-of-mine area (including Red Fork, Busse, Dunn Corner, Cold Water, Litsky and Big) can be considered to be of high importance from a hydrologic standpoint (see Table III-3). These springs generally exhibit higher rates of flow, higher quality, and year-long availability. Of the remaining springs in the life-of-mine area, 21 are of moderate importance, 13 are of low importance, and 1 is of negligible importance.

Many of the springs and seeps in and around the proposed life-of-mine area are strongly influenced by seasonal and periodic fluctuations in precipitation. Ground water flow to springs and seeps occurs as discharge from deep bedrock and from weathered shallow bedrock and alluvium. Precipitation infiltrates clinker and other recharge areas, percolates through fractured strata (bedrock) and shallow alluvium until a shale or impermeable layer interrupts flow, and discharges at springs along the impermeable barrier (see Figure III-4). Spring flow either recharges the downgradient alluvium or continues as surface flow (Meridian Minerals Company 1989-1992).

Ground water in the deeper overburden is partially confined in and below a thick sandstone unit above the Rock Mesa coal seam. The upper surface of this water zone averages about 100 feet above the Mammoth coal. Rock units below the Rock Mesa sandstone are generally saturated, though they are low yielding and have relatively poor aquifer potential.

The average quality of spring and ground water in the area is not generally suitable for public or private water supplies without treatment but is suitable for use by livestock and wildlife. Specific electric conductance of the springs averages 1561 micromhos/centimeter (cm), while sulfate concentrations average 467 milligrams per liter (mg/l), and total dissolved solids in the water average 1118 mg/l. The alluvial ground water has an average conductance of 1625 micromhos/cm, an average sulfate concentration of 535 mg/l, and an average total dissolved solids concentration of 1184 mg/l. Deeper overburden ground water averages 1644 micromhos/cm, 457 mg/l, and 1143 mg/l, respectively.

Three different evaluation systems support the ranking of the water quality as to its suitability for human drinking water or suitability for livestock, wildlife and agricultural uses, or both. They include: National Secondary Drinking Water Standards, Montana Bureau of Mines and Geology recommended limits, and State of Montana Groundwater Classifications.

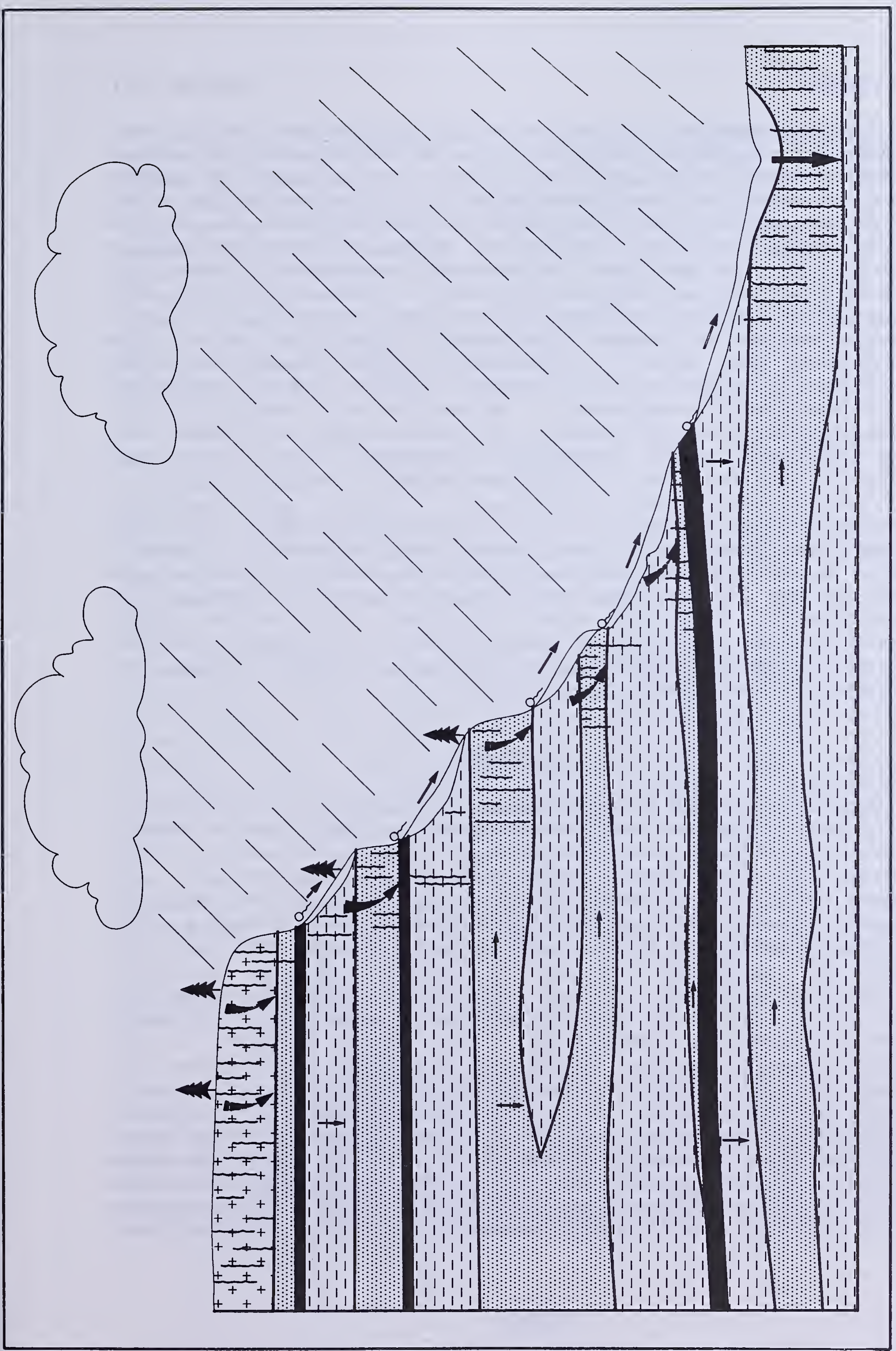

CLINKER
SANDSTONE
SHALE
COAL
DIRECTION OF GROUND WATER FLOW
SPRING

Figure III-4 Conceptual ground water model

National regulations for water quality include the National Secondary Drinking Water Standards. These standards establish maximum contaminant levels for human drinking water. The standard for sulfate in water is 250 mg/l and the standard for total dissolved solids is 500 mg/l. Average spring and ground water in the Bull Mountains area do not meet these standards. The Montana Bureau of Mines and Geology (Montana BMG) has published recommended permissible limits for inorganic constituents (minerals) in water. Montana BMG recommends maximum contaminant concentrations (in mg/l) for drinking water, use by livestock, or for irrigation. Recommended sulfate is 250 mg/l for drinking and 1500 mg/l for livestock. Total dissolved solids recommendations are 500 mg/l for drinking and 5000 mg/l for livestock. Specific electrical conductance is recommended at a maximum of 1000 micromhos/cm for drinking water. By Montana BMG recommendations, spring and ground water in the Bull Mountains area do not meet permissible limits for drinking but are suitable for livestock use.

Ground waters are divided into 4 classes by the State of Montana (see Table E-2, Appendix E). The classes are determined by a range of specific electrical conductance. Specific electrical conductance depends on the concentration of ionized minerals in solution, or dissolved solids. Using the State of Montana classification, spring and ground water in the Bull Mountains area are Class II waters, suitable for wildlife and livestock use and marginally suitable for public and private water supplies.

F. VEGETATION

Vegetation of the Bull Mountains and surrounding area north of Billings is characteristic of the Eastern Sedimentary Plains of Montana in the 10 to 14-inch precipitation zone (Meridian Minerals Company 1989-1992; ECON INC. 1991). Topography varies from uplands, rock outcrops, and ravines forested with ponderosa pine and Rocky Mountain juniper at higher elevations, to adjoining sagebrush and mixed prairie grassland communities on benches, slopes, and drainages where soils are deeper.

Existing influences on local distribution of plant communities include soils, topography, surface disturbance, availability of water, management boundaries (fencelines), and a strong gradient in soil salinity from east-to-west. Grazing by livestock, fire suppression, and a large wildfire in 1984 substantially affected plant succession in the Bull Mountains area. The region has been disturbed by over a century of farming, mining and associated activities, road building, and residential development. Grassland or prairie vegetation types originally were extensive in the western part of the Bull Mountains area, but have been replaced largely by small grain production and more recently by Conservation Reserve Program (CRP) planting (see Land Use).

Eight broad vegetation communities plus the disturbed type exist in the Bull Mountains and surrounding area: silver sagebrush-mixed grassland; mixed grassland; ponderosa pine-mixed grassland; burned ponderosa pine-mixed grassland; improved pasture; agriculture; alkali/saltgrass; wetlands; and disturbed (ECON INC. 1991). (Vegetation types are described differently in the permit application, however these 8 types are included with those listed in the permit application.) These 8 broad types summarize 19 very complex vegetative communities including 6 grassland types, 6 shrub/grassland types, 6 ponderosa pine types, and 1 tame pasture type, all occurring on the life-of-mine area (Meridian Minerals Company 1989-1992). There are 26 vegetative communities in the railroad corridor (ECON INC. 1991).

The silver sagebrush-mixed grassland community occurs on lower valley slopes near drainages, especially where soils are deeper. Perennial grasses (western wheatgrass, blue grama, and Sandberg bluegrass) comprise somewhat over one-third of the canopy cover, with forbs providing 50 percent and shrubs and subshrubs about 14 percent of the canopy cover (see Table E-9, Appendix E). The silver sagebrush-mixed grassland has received considerable grazing pressure, favoring the less palatable species that predominate.

The mixed grassland community is interspersed with the ponderosa pine-mixed grassland community in the higher elevations on upland plateaus and benches with deeper soils. Due to this topographic positioning, it has received limited grazing, resulting in perennial grass dominance and relatively high forage production. In this community, western wheatgrass, needle-and-thread, green needlegrass, blue grama, and prairie junegrass typically account for over 60 percent of total vegetative cover and three-fourths of total production. Forbs account for 29 percent of cover and 18 percent of production.

The ponderosa pine-mixed grassland community generally occurs on moderate-to-steep upland slopes on shallow soils. Ponderosa pine is a minor component of the community canopy cover but is characteristic of the type. Fifty-two percent of canopy cover is provided by grasses, including bluebunch wheatgrass, western wheatgrass, and prairie junegrass, with forbs comprising about 41 percent of cover and one-third of the herbaceous production.

The burned ponderosa pine-mixed grassland community is a transitional community resulting from a wildfire in 1984. Grasses and forbs have proliferated in the post-fire community, while ponderosa pine reproduction is not evident. This burned community differs from ponderosa pine-mixed grassland and mixed grassland by the greater occurrence of crested wheatgrass, Japanese brome, cheatgrass, Kentucky bluegrass, and common dandelion as well as diverse shrub and forb components.

The improved pasture community consists of several cultivated areas planted to introduced grasses (crested and intermediate wheatgrass) and/or alfalfa. They are grazed and occasionally hayed.

The agriculture community consists of various grain farming and land in CRP. This community predominates in the area southwest of the Bull Mountains.

The alkali/saltgrass community occurs on saline/alkaline soils in lower basins southwest of the Bull Mountains. They are poorly drained and support simple communities of salt-tolerant species such as greasewood, foxtail barley, inland saltgrass, prickly lettuce, seepweed, and Nuttall's alkaligrass. Several noxious weed infestations are prevalent and appear to be actively spreading.

The wetland vegetation community accounts for less than 0.1 percent of the Bull Mountains and surrounding area communities but plays an important role in local ecosystems. Wetlands provide watering points for wildlife and livestock and provide habitat diversity. Species include several sedges, rushes, bulrush, cattail, western rose, and snowberry. They are associated at higher elevations primarily with springs, seeps, and intermittent streams, and at lower elevations with small, developed ponds and dams. Precipitation-dependent wetland sites fluctuate annually, in a range from dried out to wet, in direct response to seasonal moisture, temperature, and wind. There are 49 springs in the life-of-mine area, all of which are important to the vegetation communities they support. However, of the 49 springs in the life-of-mine area, 5, including Busse, Cold Water, and Litsky have a high degree of importance for vegetation (see Table III-3). Of the remaining springs, 4 have moderate importance, 21 have low importance and 19 have negligible importance to the overall life-of-mine area vegetation.

The disturbed type includes subdivision homesites, ranch and farm sites, industrial, commercial, roads, powerlines, and other manifestations of human use (Meridian Minerals Company 1989-1992; ECON INC. 1991a). The Huntley loadout is a commercial-use area originally created from river-bottom rangeland (see Appendix B).

G. WILDLIFE

Eight broad vegetation communities plus the disturbed type provide wildlife habitat in the Bull Mountains and surrounding area (see Vegetation). Vegetation communities are considered synonymous with wildlife habitat types in this section. Ponderosa pine-mixed grassland, and burned ponderosa pine communities are most common at higher elevations of the Bull Mountains, with mixed grassland and silver sagebrush-mixed grassland common at intermediate elevations. Mixed grassland; improved pasture; agriculture, including Conservation

Reserve Program (CRP) lands; and alkali/saltgrass basins occur in the western, lower elevations. Very small acreages of the wetlands community may occur at all elevations. Of the 49 springs in the life-of-mine area, 8 springs, including Busse, Cold Water, Litsky, and Black Canyon are of high importance to wildlife. Sixteen are of moderate importance, 11 are of low importance, and 14 are of negligible importance (see Table III-3).

Mule deer are the most abundant and sought-after game species in the Bull Mountains and surrounding area, while white-tailed deer are seldom observed (Dusek 1978; Meridian Minerals Company 1989-1992; ECON INC. 1992a). Mule deer in the Bull Mountains are essentially nonmigratory, making modest seasonal movements caused by changes in forage conditions and weather. Deer can be observed using all vegetation communities throughout the area, both adjacent to areas of human activities and in more isolated areas during all seasons. In lower elevations, mule deer use agricultural lands heavily, particularly CRP fields where cover is much taller and denser than in grain or stubble fields. In the higher elevations, deer preference is for the ponderosa pine-mixed grassland vegetation community. During the winter, this community is used considerably more than would be indicated by its availability for thermal cover and food provided by the shrub component of the community. Winter observations indicate mule deer concentrated in 3 areas; the Rehder Creek drainage and across Fattig Creek Road north of the life-of-mine area, the east end of Elbow Hill, and along Fattig Creek at the north edge of the life-of-mine boundary. Use of the area west and south of the PM Mine increased as winter progressed.

A migratory herd of 92-100 elk use the Bull Mountains (Dusek 1978). Elk are the second-most numerous game animal and are distributed throughout the higher elevations, generally in areas away from human activity. Portions of Rehder, Parrot, and Fattig Creek drainages are used as summer range while Railroad and Pompey's Pillar Creek drainages serve as winter range. Some winter use occurs on the south side of Dunn Mountain. In winter, elk or their evidence have been observed occasionally throughout the life-of-mine area including some use on the south side of Dunn Mountain. Elk tend to concentrate on south-facing or other slopes blown free of snow. Spring observations of cow/calf groups in the vicinity of Dunn mountain suggest the area could be used for calving.

The central Bull Mountains are marginal antelope habitat. Open habitat such as silver sagebrush-mixed grassland, mixed grassland, and agriculture communities in the eastern part of the area, are fragmented and interspersed with the ponderosa pine-mixed grassland community. Antelope distribution in the life-of-mine area is both seasonal and relatively dispersed, occurring in spring, summer, and early fall. No critical antelope habitat types have been identified, however, antelope use most major drainages in the life-of-mine area. It is unlikely that antelope would intensively use higher elevations due to lack of suitable habitat and cover, and human activity. The western portion of the area has regular antelope use of agricultural and CRP fields (Cole 1956; Cole and Wilkens 1958). In summer and particularly in winter, antelope tend to be concentrated in large herds in nearby Hay and Commanche basins.

Merriam's wild turkeys are year-round residents of the Bull Mountains area. Turkeys are not native, having been introduced into the Bull Mountains in 1958 and having since spread throughout the area. They are readily observed in the ponderosa pine-mixed grassland community (preferred habitat), and the agriculture community (Greene and Ellis 1971). The ponderosa pine-mixed grassland community provides roosting trees year-round, thermal cover during cold weather, and food during all seasons for wild turkeys (Jonas 1966).

Adaptable sharp-tailed grouse are also year-round residents of the Bull Mountains area but use somewhat differing vegetation communities on a seasonal basis. Grouse use silver sagebrush-mixed grassland and mixed grassland communities for courtship, nesting, and brood rearing in spring and summer, and use the other communities to some degree for food and cover during fall and winter. A dancing ground (lek) is located within the life-of-mine area. It is in a disturbed area (next to a road sign) along the PM Mine access road. In the proposed railroad corridor, a dancing ground is located immediately adjacent to the proposed rail line. Grouse have also been observed on a possible second dancing ground on a narrow ridge of mixed prairie type between agricultural and burned ponderosa pine communities along the rail corridor.

Non-native Gray partridge and ring-necked pheasant are not observed frequently, but are present in the western agricultural community (Weigand and Janson 1976; Weigand 1980). With about 50 percent of agricultural land converted to CRP, both species should benefit from increased undisturbed "permanent" cover and respond with an increase in numbers and area occupied (Weigand and Janson 1976; Weigand 1980).

Sage grouse are sagebrush-dependent, and their habitat is very limited in the Bull Mountains area, most of it having been converted to agriculture decades ago. A few individuals have been seen in the proposed railroad corridor. With the dependency this bird has on sagebrush, particularly in the winter (Eng and Schladweiler 1972), this area has little chance of supporting more than a remnant population.

Fourteen species of raptors have been observed within the Bull Mountains and surrounding area in all major habitat types. The greatest number of species was observed during the spring and fall migration. The rough-legged hawk (an arctic nesting species) is the most common winter raptor. Spring and summer residents (red-tailed hawk, kestrel, and great horned owl) comprise most of the breeding season observations. The red-tailed hawk and the kestrel are the most frequently observed species, though raptor densities are quite low. Golden eagles have been observed at all times of the year. Other raptors present include the prairie falcon, ferruginous hawk, Cooper's hawk, turkey vulture, northern harrier, sharp-shinned and Swainson's hawks, and short-eared and burrowing owls (ECON 1992a; Meridian Minerals Company 1989-1992). Many raptors undoubtedly nest in the general area, but only 3 red-tailed hawk nests and a great horned owl nest have been found in the life-of-mine area. Turkey vultures, red-tailed hawks, kestrels, prairie falcons, and great horned owls are expected to nest in the western Bull Mountains areas, using cliff nests located in cavities or ledges of sandstone outcrops. Cliff-nesting sites are quite well-distributed in association with the ponderosa pine-mixed grassland and burned ponderosa pine-mixed grassland communities (Harrison 1979). Other raptors use trees, snags and hillsides for nesting. Suitable nesting habitat is abundant for raptors in the Bull Mountains and surrounding area. The bald eagle migrates through the area in spring and fall (Swenson et al. 1981). There have been 4 sightings of wintering bald eagles.

Seventy-three other bird species are known to inhabit higher elevations of the Bull Mountains, using 5 vegetation communities: ponderosa pine-mixed grassland community; burned ponderosa pine-mixed grassland community; mixed-grassland community; silver sagebrush-mixed grassland community; and the agricultural community (Meridian Minerals Company 1989-1992). The burned ponderosa pine-mixed grassland community provides an extraordinary abundance of snags as nesting habitat for cavity-nesting small birds such as woodpeckers, swallows, bluebirds, and wrens (Scott et al. 1977; Scott and Oldemeyer 1983; ECON INC. 1992a).

Ninety-six species of birds are known to use the lower, western portions of the Bull Mountains area, including 11 waterfowl species and 15 species associated with wetlands (see Table 10, Appendix E), (Skaar, Flath, and Thompson 1985; ECON INC. 1992b). Forty-five species of birds have been observed in the vicinity of wetland areas in the life-of-mine area (Meridian Minerals Company 1989-1992).

Several wildlife species belonging to such diverse groups as mammalian predators, aquatic birds, amphibians, and reptiles, can be observed within the Bull Mountains area. The coyote is common throughout the area. Other species include Nuttall's cottontail, Richardson's ground squirrel, black-tailed prairie dog, and least chipmunk.

Aquatic habitat in the area includes streams, ponds, springs, seeps, and areas associated with the wetland community. The Rehder, Fattig, and Railroad Creek drainages are ephemeral; however, there are perennial ponds and stream reaches created by flow from springs.

Approximately 15 acres of wetland habitat occurs in the life-of-mine area, of which 3 acres are open water. A number of wet sites remain relatively undisturbed by current land use practices, however, many aquatic sites have been modified by livestock grazing or development of livestock watering facilities. Additional disturbances to the aquatic environment of the area include the 1984 fire and subsequent loss of insulating cover, and increases in siltation from runoff and cattle disturbance. All animals found in the mine plan area use the streams, ponds, and springs, and related habitat to a greater or lesser degree.

Water birds and shorebirds use pond, spring, and stream areas. Other birds occupy riparian zones and/or harvest insects that emerge from wet areas. The aquatic invertebrate community is characterized by low-to-moderate species diversity, densities, and productivity. Species are predominantly those typical of standing water, however, a number of the taxa represented are found only in lotic (flowing water) habitats. The dominant invertebrate species are generally tolerant of widely varying conditions and are typically transient in nature or bottom dwellers that prefer standing water. Species from the midge (Chironomidae), mayfly (Ephemeroptera) and fly (Diptera) families dominate the invertebrate community, with aquatic earthworms (Oligochaeta) and amphipods also well represented. The periphyton communities (e.g., algae, bacteria, and protozoa) present in the springs, ponds, and streams are not common in eastern Montana, and indicate a higher water quality than is usually encountered in this part of the State (Dr. Loren Bahls, Dept. of Health and Environmental Sciences, personal communication, March 25, 1992). Of the 49 springs in the life-of-mine area, 4 springs, Busse, Cold Water, Litsky, and Black Canyon, are of high importance to aquatic organisms. Seven springs are of moderate importance, 17 are of low importance, and 21 are of negligible importance to aquatic organisms.

The primary aquatic/semiaquatic vertebrate species associated with the wetland community include the tiger salamander, chorus frog, and northern leopard frog. Painted turtles and an unidentified toad have also been observed. No fish species have been found in any of the ponds or stream reaches.

H. TRANSPORTATION

1. Transportation

Musselshell and Yellowstone counties are served by an extensive network of Federal, State and County roadways. Public bus transportation is available in the area from Intermountain Transportation Company. Public airports are located in Billings and near Roundup. Freight rail service is available in Broadview and Huntley.

2. Roadway Network

Fattig Creek Road is a 2-lane, improved, all-weather roadway that extends from Old Divide Road, northeast through the proposed mine area, to U.S. Highway 12. Old Divide Road is a 7-mile, 2-lane paved road that parallels U.S. Highway 87, starting and ending at intersections on U.S. Highway 87 (see Figure I-2). Both Fattig Creek and Old Divide roads are maintained by Musselshell County. In the area traversed by the proposed rail spur there are a number of roads. In Mussellshell County, the County-maintained roads are Golding Creek Road, Daly Road, and the western end of Majerus Road. (Norma Wegmann, Musselshell County, personal communication, August 4, 1992). In Yellowstone County, the major roads are 21 Mile, Frey, Van Sky, and Oswald roads. (Suzette Summers, Yellowstone County, personal communication, August 4, 1992.) The named roads are County-maintained, all weather, gravel roads except for a paved section of 21 Mile Road east of Broadview.

U.S. Highway 87 and Montana Route 3 are Federal-aid Primary System (FAP), 2-lane paved roads maintained by the Montana Department of Transportation (MDT). U.S. Highway 87 extends from Billings, north through Roundup and Grassrange then northwest toward Great Falls. It travels through mostly level and rolling terrain with some steep grades and limited sight distance on some hills. Montana Route 3 extends from Billings, northwest through Acton and Broadview, ending just north of Lavina at a junction with U.S. Highway 12. Montana Route 3 is generally level terrain south of Broadview.

Highway 312 is a 2-lane paved road (4 lanes approaching the U.S. 87 intersection) maintained by MDT. Until it was replaced by Interstate 90, Highway 312 was part of the FAP System and served as the principal east/west arterial highway to Billings. Heath Street and Northern Avenue are 2-lane paved roads in Huntley, maintained by Yellowstone County. Heath Street serves both residential and industrial land uses in east Huntley.

MDT, through its pavement management system, evaluates the overall condition of State-maintained roadways every 2 years. This evaluation, used to identify potential highway improvements, includes pavement conditions (travel surface and structure), safety and traffic capacity.

MDT has several highway reconstruction projects planned along U.S. Highway 87 and Montana Route 3 (see Appendix B). These projects include pavement and shoulder widening, and strengthening and repaving of the travel surfaces. Along U.S. Highway 87, several segments have poor overall conditions. These segments are located about 7 miles north of Highway 312 and extending to about 1 mile south of the southern Old Divide/U.S. Highway 87 intersection. Along Montana Route 3, a section starting at the Yellowstone-Golden Valley county line and extending south to near the Billings city limits has poor overall conditions. Highway 312 has good overall pavement condition starting from U.S. Highway 87/Highway 312 intersection extending east through Huntley (John Wright, Montana Department of Transportation, personal communication, January 27, 1992).

3. Intersections

Three intersections of interest in connection with the proposed Project are the 2 U.S. Highway 87 intersections with Old Divide Road and the U.S. Highway 87 intersection with Highway 312.

Neither the northern or southern Old Divide Road/U.S. Highway 87 intersections are controlled by traffic lights. Adequate line-of-sight distance is available at both intersections. Due to a curve on U.S. Highway 87, there is slightly greater sight distance at the northern intersection. (Donald P. Dusek, Montana Department of Transportation, personal communication, May 31, 1991). The major difference between the intersections is the vertical grade of U.S. Highway 87. Vehicles turning left (south) from the northern Old Divide Road/U.S. Highway 87 intersection onto U.S. Highway 87 may be delayed in accelerating to highway speed by a 4 percent upgrade for about 3,400 feet. Vehicles turning left (south) from the southern Old Divide Road/U.S. Highway 87 intersection onto U.S. Highway 87 encounter a 1.33 percent downgrade, and are aided in accelerating to normal travel speeds (Donald Dusek, pers. comm., May 31, 1991).

Although the U.S. Highway 87/Highway 312 intersection has no standard traffic signal light control, (it only has flashing yellow and red lights), it meets the minimum vehicular requirements for standard signals, as established by the Manual on Uniform Traffic Control Devices (Federal Highway Administration 1990). (Donald W. Cromer, Montana Department of Transportation, personal communication, November 18, 1991).

The northbound and southbound approaches of the U.S. Highway 87/Highway 312 intersection are controlled by stop signs supplemented by flashing red light. Both approaches consist of 2 lanes; a shared left-turn/through lane and a right-turn lane. The eastbound and westbound approaches are controlled only by flashing yellow light. These 2 approaches consist of 4 lanes; a left-turn lane, 2 through lanes and a right-turn lane. There is adequate sight distance on all of the intersection approaches. Vertical grades of all of the approaches are level, and do not affect vehicle operation through the intersection. Southbound to eastbound left-turns and westbound to northbound right turns are difficult for large trucks because the turns are greater than 90 degrees. Truck tires tend to ride up onto the curb or track off the pavement onto the shoulder when making the westbound to northbound right turn. As a result, trucks make this turn slower than other vehicles (Donald Dusek, pers. comm., May 31, 1991).

4. Existing Traffic

The current Average Daily Traffic (ADT) for Fattig Creek Road is about 15 vehicles. Along Old Divide Road, the ADT is about 40 vehicles (Sandy Haugsval, Musselshell County, personal communication, January 24, 1992). The ADT on U.S. Highway 87 varies from 2,570 vehicles, near the Highway 312 intersection, to 1,560 vehicles, north of the northern Old Divide Road intersection. Truck and heavy vehicle traffic accounts for about 10 percent of the total traffic volume traveling on U.S. Highway 87 (Donald Cromer, pers. comm., November 18, 1991).

ADT on Highway 312 varies from 7,000 vehicles at the U.S. Highway 87 intersection, to about 2,400 vehicles east of Huntley. The percentage of truck and heavy vehicle traffic varies from about 9 percent at the U.S. Highway 87 intersection to about 5 percent near Huntley (Donald Cromer, pers. comm., November 18, 1991).

The ADT on Montana Route 3 varies from about 1,200 vehicles, north of Acton, to about 1,100 vehicles near the Musselshell-Yellowstone county line. (Donald Cromer, pers. comm., November 18, 1991).

No ADT figures are available for County roads along the rail spur route. It is estimated that the ADT is about 5 to 15 vehicles per day.

5. School Bus Routes

Five school systems operate buses in the area; the Roundup Public School District, Shepherd School District, Pioneer School District (in Billings), Billings School District, and Huntley Project Schools. Peak hours of bus activity on Highway 312, from U.S. Highway 87 through Huntley, and U.S. Highway 87 from Highway 312 to Roundup are from 6:45 to 8:15 a.m. and 3:10 to 4:45 p.m.. Limited bus traffic occurs on Highway 312 starting at 2:00 p.m. on Wednesdays. On U.S. 87 there is limited bus traffic starting at 2:20 p.m. on all school days.

The Independent School is located just north of the U.S. Highway 87/Highway 312 intersection and has an at-grade pedestrian crossing of U.S. Highway 87. Peak pedestrian and local service traffic (picking up and dropping off children) occurs from 7:00 to 8:00 a.m. and 3:30 to 4:30 p.m.

6. Capacity

Capacity is generally defined as the ability of a facility to accommodate vehicles or persons over a defined time period, given prevailing roadway and traffic control conditions. Levels-of-Service (LOS) is used to qualitatively describe the operational conditions within a traffic stream, and the perception by motorists and/or passengers. The 6 levels associated with LOS are designated as "A" through "F." LOS "A" represents free flow conditions while LOS "F" represents a disruption or breakdown of traffic flow (Transportation Research Board 1985).

The current LOS on Fattig Creek and Old Divide roads is "A." The LOS of the Fattig Creek Road/Old Divide Road intersection and both northern and southern Old Divide Road/U.S. Highway 87 intersections is "A" at all times. Vehicles can turn onto or from U.S. Highway 87 with little or no delay.

The current LOS for U.S. Highway 87 range from "A" to "D." Upon completion of the planned reconstruction projects, the LOS will range from "A" to "C." Traffic flow is generally stable and acceptable along U.S. Highway 87 (Donald Cromer, pers. comm., November 18, 1991).

There is congestion at the U.S. Highway 87/Highway 312 intersection during peak travel periods. Vehicles turning left from the northbound and southbound approaches experience delays moving through the intersection. The LOS of the northbound and southbound approaches is "E" during both the a.m. and p.m. peak travel periods (Donald Cromer, pers. comm., November 18, 1991).

The LOS on Highway 312 varies from "B" near Huntley to "D" near the U.S. Highway 87 intersection (Donald Cromer, pers. comm., November 18, 1991). There is stable and acceptable flow from Huntley to west of the U.S. Highway 87 intersection. Near here flows become more congested and less stable when traffic increases on Highway 312.

The current LOS on Montana Route 3 south of Broadview is "B." There is stable and acceptable flow along this segment of Montana Route 3.

7. Accident History

MDT keeps records on the number and severity of all accidents on State-maintained roadways. Accident rates are expressed in accidents per million vehicle-miles. MDT also computes an accident severity rate for State-maintained roadways. This is defined as the ratio of fatal, injury, and property damage accidents to the total number of accidents on a roadway. The expression of the number and severity of accidents as rates allows direct comparison of the relative safety of State-maintained roadways.

The accident rate on U.S. Highway 87 is 1.19. This is lower than the 1.72 statewide average for an FAP roadway. The severity rate of accidents along U.S. Highway 87 is 1.78, and is greater than the 1.53 statewide average FAP severity rate (Donald Cromer, pers. comm., November 18, 1991). This means there are fewer accidents per million vehicle-miles on U.S. Highway 87 compared to the statewide average for other FAP roadways, but the accidents are more severe.

The accident rate on Highway 312 of 1.74, is greater than that for an FAP roadway but less than the 2.10 rate for a Federal Aid Secondary (FAS) roadway. The severity rate of 1.50 for Highway 312 is less than the rate for both FAP and FAS roadways (Donald Cromer, pers. comm., November 18, 1991). In this case, there are more accidents per million vehicle-miles on Highway 312 compared to the statewide average of FAP roadways, but fewer accidents per million vehicle-miles when compared to the statewide average for FAS roadways. Accidents occurring along Highway 312, are generally less severe than those on other FAP and FAS roadways within the State. Along Montana Route 3, the accident rate of 1.12 and severity rate of 1.59 are both lower than the FAP statewide average (Hank Butzlaff, Montana Department of Transportation, personal communication, January 24, 1992).

I. NOISE

1. Introduction

Noise can be characterized as unwanted, unpleasant sound. It can cause hearing losses, interfere with speech communication and the performance of complex tasks, and disturb sleep. Noise may be either intermittent or continuous, steady or impulsive. It can result from a broad range of sources and frequencies blending together or from one specific sound. The human response to noise is diverse and varies with the type of noise, time of day, and sensitivity of the individual.

Noise, as a physical phenomenon, refers to sound pressure variations audible to the ear. Sound pressures audible to the human ear typically range in amplitude from $2x10^{-5}$ to 200 Pascals, (i.e., a range of 10^7 or 10,000,000). A logarithmic unit known as the decibel (dB) was borrowed from electrical engineering to represent sound level. The dB is a dimensionless unit related to the logarithm of the ratio of the measured level to a reference level.

The ear is not equally sensitive at all frequencies of sound. At low frequencies, characterized as a rumble or roar, the ear is not very sensitive while at higher frequencies, characterized as a screech or a whine, the ear is most sensitive. The dBA was developed to measure and report sound levels in a manner more closely approaching how people perceive sound. Figure III-5 presents typical dBA levels for various sources in outdoor rural and urban environments and common indoor noise levels.

A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness. This is true for loud and soft sounds. For example, a gas lawn mower at 100 feet would be about twice as loud as heavy traffic at 300 feet (see Figure III-5). Noisy urban daytime sounds would be perceived as being about four times as loud as heavy traffic at 300 feet.

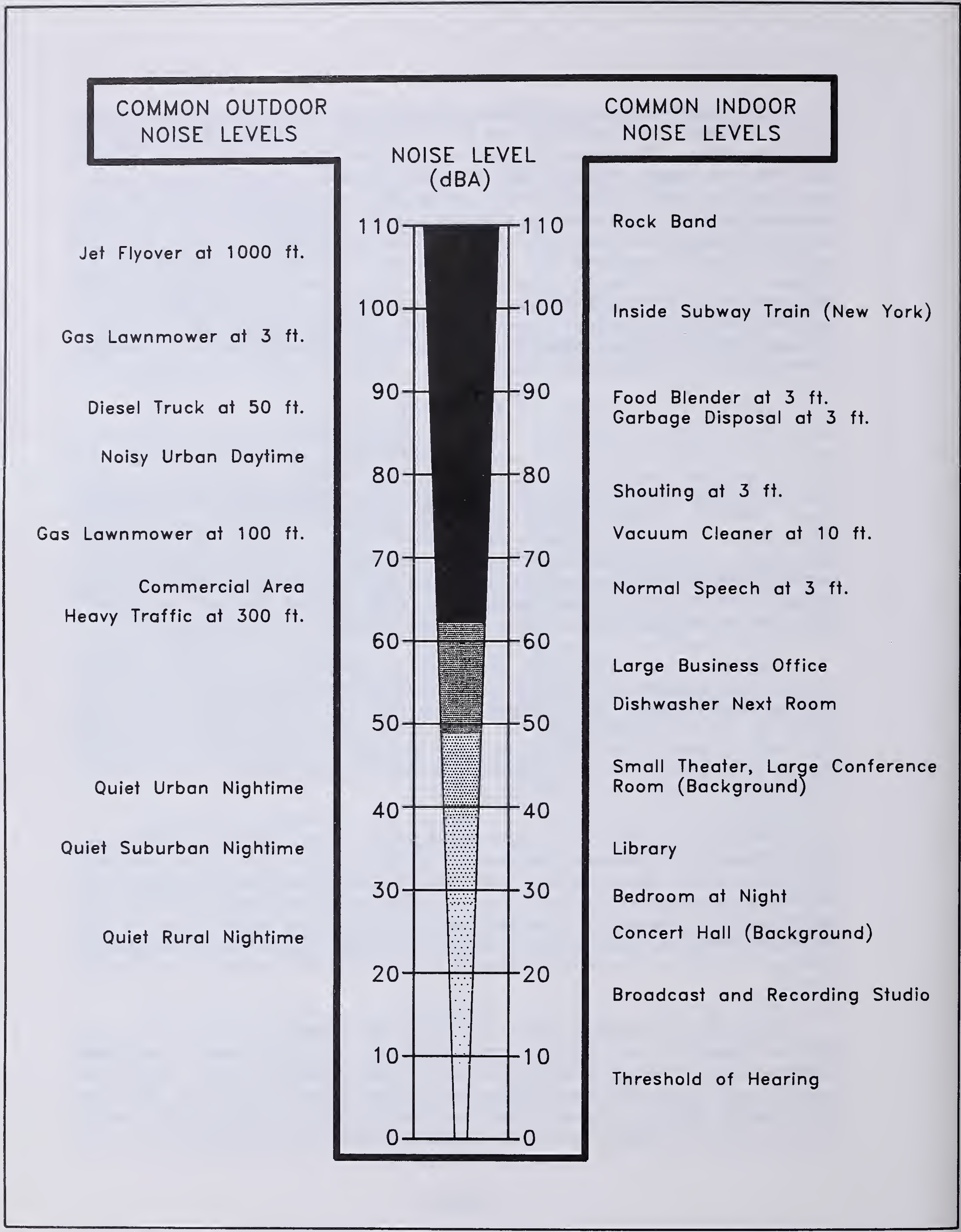


Figure III-5 Comparative noise levels

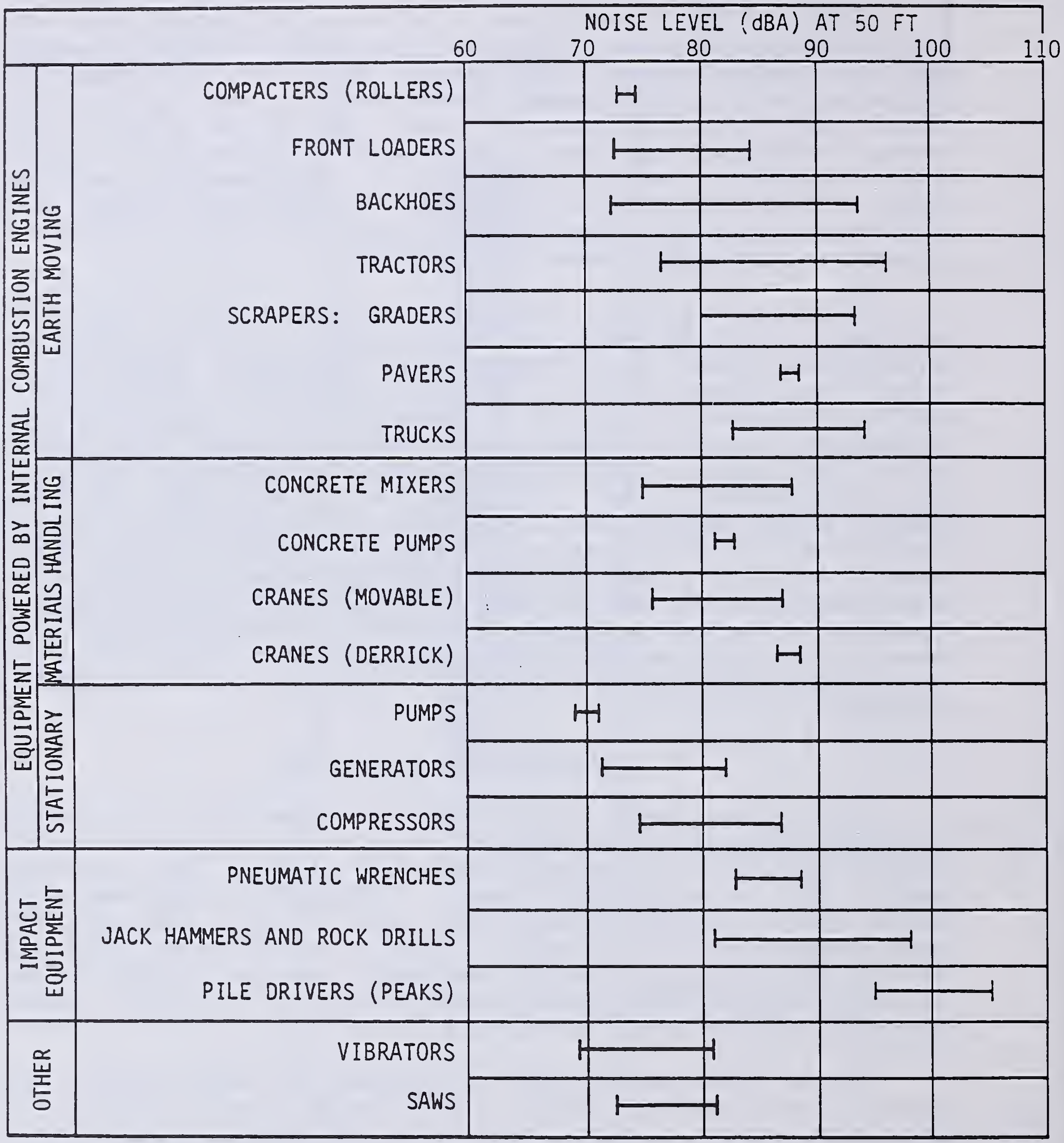
A "metric" used in environmental noise analysis refers to the unit or quantity that measures or represents the effect of noise on people. The metric called the day-night average sound level (DNL) has been adopted by the U.S. Environmental Protection Agency (EPA) as the rating method used to describe community noise. DNL is the 24-hour energy average, A-weighted sound level with a 10 dB weighting added to those levels occurring between 10 p.m. and 7 a.m. This penalty is added to account for the fact that noise at night is judged more annoying than the same noise during the day. The expression L_{dn} is used in this report to designate day-night average sound levels.

EPA has identified a range of yearly day-night sound levels sufficient to protect public health and welfare from the effects of environmental noise (U.S. Environmental Protection Agency 1974). Outdoor yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 55 dBA in sensitive areas (residences, schools, and hospitals). Inside buildings, yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 45 dBA. Maintaining an L_{dn} noise level of 55 dBA outdoors should ensure adequate protection for indoor living. Because these protective levels were derived without concern for technical or economic feasibility, and contain a margin of safety to ensure their protective value, EPA has indicated that they should not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there is not reason to suspect that the general population will be at risk from any of the identified effects of noise.

2. Existing Noise Environment

Current noise levels in and around the proposed mine area are from activities conducted at the PM Mine. Construction equipment, back-up alarms, wash-plant operations, vehicular traffic, and occasional blasting are the major noise sources. Construction equipment noise levels should currently range from about 72 to 95 dBA near the preparation facility to an ambient level of 40 dBA about 4,500 feet from the PM Mine area. During the night, when the PM Mine is not operating, ambient noise levels should be about 35 to 40 dBA. Typical construction noise levels are shown in Figure III-6.

Current noise levels along the proposed rail spur are from farm machinery and occasional traffic on rural roads. Because there are no major noise sources, L_{dn} noise levels of 35 dBA, typical of rural areas, should exist along the proposed right-of-way. When farm machinery and occasional traffic are present, noise levels may reach as high as 75 to 95 dBA at 50 feet and should drop to about 55 to 58 dBA 1,000 feet from sources.



Note: Based on Limited Available Data Samples.

Source: EPA 1971.

Figure III-6 Construction equipment noise ranges

Existing noise levels along the proposed coal-hauling route are principally due to vehicular traffic. L_{dn} values 100 feet from the edge of the road are about 59 dBA on both U.S. Highway 87 and Highway 312.

Existing noise levels in Huntley are primarily from vehicular traffic on Northern Avenue and Heath Street. Noise levels have not been measured in this area but can be approximated from traffic levels on these roads. During October, sugar beet truck traffic is the dominant noise source in the area. L_{dn} levels 100 feet from Northern Avenue and Heath Street may range from 50 to 55 dBA. From November through January, when beets are hauled to the factory, beet-truck traffic is less, and L_{dn} values would be about 45 to 50 dBA. During the remaining months of the year, traffic is greatly reduced and L_{dn} levels should range from 40 to 45 dBA.

J. SOCIOECONOMICS

1. Employment, Personal Income, and Population

In 1989, employment in Musselshell County totalled 1,850 and was dominated by farm-related jobs; 20 percent of all employment in the County was farm-related (see Table E-12, Appendix E). Secondary employment, consisting primarily of jobs in retail trade, services, and government sectors, totalled 50 percent of all jobs in the County. Total employment in Musselshell County declined by 94 jobs between 1980 and 1989. Most of the decrease occurred in the mining sector (162 jobs lost) and the retail trade sector (33 jobs lost). During this same period, the number of jobs increased slightly in the transportation and utilities industry, while the services industrial sector realized an increase of 118 jobs.

Historically, Yellowstone County has served as a commercial trade center for southeastern Montana and, consequently, most jobs in the County have been related to the retail trade and service sectors (see Table E-12, Appendix E). In 1989, farm employment in Yellowstone County comprised 2 percent of total jobs; less than either the Musselshell County or statewide percentages. Since 1980, employment in Yellowstone County has increased 14 percent; however, most gains in employment have been in the lower paying secondary jobs (services and retail trade), while the number of higher paying jobs in mining, construction, manufacturing, and transportation has decreased.

Unemployment in Musselshell County has declined from a high of 10.6 percent in 1986 to the present level of 7.8 percent (see Table E-13, Appendix E). The decline occurred because of the decrease in the available labor force and the absence of any new employment opportunities. In the past, the unemployment rate in Musselshell County has been 1 or 2 percent higher than the statewide rate, except in the late-1970s and early-1980s when oil field activity was peaking. In Yellowstone County, unemployment has been lower than the statewide rate since 1980, and stood at 4.8 percent in 1990.

Total personal income and earnings by industrial sector for the State of Montana, and Musselshell and Yellowstone counties are detailed in Table E-14, Appendix E. In 1989, earnings totalled $29.3 million in Musselshell County and were dominated by earnings from farm, transportation and utilities, services, and government jobs. Earnings from mining activities, including oil and gas exploration, have declined from 15 percent of total personal income in 1980 to the present level of 4.5 percent. During this same period, farm earnings increased from $1.7 million to $5.5 million. In Yellowstone County, the major source of earnings was the services sector, with slightly over 20 percent of total personal income attributed to this secondary industry.

Between 1980 and 1990, the population of Musselshell County decreased by 322 people or about 7.3 percent (see Table E-15, Appendix E). Most of the population loss in Musselshell County occurred in Roundup; population declined from 2,116 in 1980 to 1,808 in 1990. Population changes in Yellowstone County have closely paralleled statewide changes since 1970. The population of Yellowstone County increased from 108,035 in 1980 to 113,419 in 1990; however, this small increase represented an actual net out-migration over the 10-year period.

Projections of population and economic characteristics for the area indicate growth rates similar to those experienced between 1970 and 1990 (see Table E-16, Appendix E). Over the 20-year projection period, the population of Musselshell County, without consideration for the proposed Project, is expected to grow at an annual rate of 0.5 percent to 4,615 people (National Planning Association Data Services, Inc. 1991). This projected growth is nearly identical to the 1970-90 population growth rate for the County. By the year 2010, employment in Musselshell County is projected to increase by about 10 percent to a level of 2,052 jobs. Both employment and population growth rates of Musselshell County are representative of a stable economy with little or no economic expansion projected. Similarly, the outlook for Yellowstone County is reflective of little or no growth over the next 20 years. The population of Yellowstone County is projected to grow from 113,419 in 1990 to 134,968 by 2010, representing an approximate annual growth rate of 0.9 percent. Employment is projected to grow at an annual rate of 1.4 percent, from 70,279 in 1990 to 92,981 by 2010.

2. Public Sector Fiscal Conditions

Property taxes are the most important source of funding for Musselshell County and annually account for nearly two-thirds of all revenues. In Montana, property taxes are based on the taxable valuation of a county and, in fiscal year (FY) 1992, Musselshell County had a total taxable valuation of $6.8 million (Montana Department of Commerce 1991). In FY 1992, Musselshell County adopted an annual budget of about $1.5 million, including $817,301 for general fund purposes. In FY 1992, the city of Roundup had a taxable valuation of $1.5 million and an annual general fund budget of about $349,410. Property taxes account for nearly two-thirds of Roundup's revenues.

In FY 1992, Yellowstone County, which provides services for the communities of Huntley and Shepherd, adopted a total budget of $39.9 million including about $9.9 million for general fund purposes (Montana Department of Commerce 1991). About one-half of the budget is funded by property taxes based on a total taxable valuation of $184.4 million. In FY 1992, Billings, the County seat of Yellowstone County, adopted a total budget of $55.4 million. The total budget included projected general fund expenditures of $44.0 million, based on a total taxable valuation of about $106.0 million. About one-third of this total budget is funded through property taxes. During the same fiscal period, the town of Broadview had an annual general fund budget of $9,974 based on a taxable valuation of $139,304.

Maintenance and construction budgets for Highway 312, U.S. Highway 87, and Montana Route 3 are the responsibility of the Montana MDT. Musselshell County has fiscal responsibility for Old Divide Road while Yellowstone County maintains streets in Huntley. The primary source of revenue for maintaining State highways is the State fuel tax and gross vehicle weight (GVW) tax. Construction of State highways also is funded by State fuel taxes; however, matching Federal funds account for about 67 percent of all highway construction in Montana. Traditionally, Montana has received approximately 2 dollars in Federal-aid highway funds for every dollar of Federal fuel tax collected in the State (Montana Department of Transportation 1991).

Average annual maintenance costs for 1989-91 were $126,620 for U.S. Highway 87, $38,654 for Highway 312, and $175,320 for Montana Route 3 (Tim Morris, personal communication, March 18, 1992). The MDT does not attempt to justify whether or not traffic, and related fuel and GVW tax on any roadway in Montana, support the cost of maintenance or reconstruction. Furthermore, local governments do not track maintenance costs of roadways by location, therefore operation and maintenance costs are not available for Old Divide Road or Heath Street in Huntley.

Local governments in Montana levy an assessment against property-taxable valuation to fund maintenance and construction of roadways. For FY 1992, Musselshell County levied 18.158 mills to raise $339,440 for operation and maintenance of County roads (Montana Department of Commerce 1991). During this same time period, Yellowstone County levied 16.37 mills to fund a road operation and maintenance budget of $2.8 million.

General fund expenditures for area school districts usually account for about two-thirds of the school budget. Nearly all general fund-related revenues are realized through property taxation. In attempting to equalize school budgets throughout the State, the 1988 legislature shifted the balancing of financing general fund budgets from local districts to State and County equalization. At present, it is the goal of the legislature to finance about 80 percent of all school district general fund expenditures through equalization.

In FY 1992, general fund budgets per elementary student enrolled varied from $2,690 at Shepherd to $12,350 at Broadview (Office of Public Instruction 1991). General fund monies spent per elementary school student were about $3,093 in Roundup Elementary School District, $3,210 in Billings, and $2,985 Huntley. At the high school level, general fund budgets varied from $3,779 per student in Billings to $6,914 per student in Broadview. Roundup School District budgeted $4,404 per high school student in general funds, while Shepherd School District expected to spend $4,545 per high school student. In this same time period, Huntley School District projected that it needed $4,620 in general fund monies per high school student. In FY 1992, the statewide average general fund expenditures per student were $3,058 for elementary students and $6,200 for high school students.

3. Public Water Supply, Wastewater Treatment, and Solid Waste

Municipal water for Roundup residents is obtained from 2 sources. The primary water source originates in an abandoned coal mine on the south side of the Musselshell River and is supplemented by water from the Musselshell River. Water is stored in 2 concrete reservoirs with a combined capacity of 3 million gallons. The water supply, pumping capability, and storage capacity of the Roundup municipal water system are adequate for present population. The Roundup municipal wastewater treatment facility consists of a 2-cell lagoon system. The system is well maintained, in adequate condition, and underutilized.

The Broadview community water supply is served by 2 wells with a combined capacity of 92 gpm (Jerry Burns, Montana Department of Health and Environmental Sciences, personal communication, July 2, 1992). Water is stored in a 21,000-gallon tank. The water system is in good condition and is adequate to accommodate some new households and businesses. The 2-cell lagoon wastewater system in Broadview is in good condition and could serve a larger population (Jerry Burns, pers. comm., July 2, 1992).

Huntley receives its public water from a well and stores the water in a 18,000-gallon tank. The capacity of the Huntley water system is low for the population served, and the community probably should install a second well to provide a backup water source (Jerry Burns, pers. comm., July 2, 1992). Individual septic tank systems are used by Huntley residents for wastewater disposal.

Solid waste collection and disposal in Musselshell County are provided by the Musselshell County Refuse District. Refuse is picked up and hauled to the Roundup transfer station where it then is hauled by a private contractor to the Billings landfill for disposal. The transfer station operation is functioning below capacity. Solid waste in Yellowstone County is collected and disposed of in the Billings landfill which, with no recycling, has adequate capacity until year 2045 (Jim Flisrand, Billings Solid Waste Collection and Disposal, personal communication, June 30, 1992).

4. Law Enforcement and Fire Protection

Law enforcement in the area is provided by the Montana Highway Patrol, Musselshell and Yellowstone County Sheriff's departments, and Billings Police Department. The Highway Patrol concentrates on traffic patrol and traffic-related incidents, whereas the sheriff's departments focus on criminal activity in Musselshell and Yellowstone counties. There are an adequate number of highway patrol officers to serve the Billings area; however, the Roundup area needs more officers (Captain Craig Reap, Montana Highway Patrol, personal communication, June 30, 1992; Captain Don Seyfert, Montana Highway Patrol, personal communication, June 30, 1992).

The Musselshell County Sheriff's Department, a consolidated city (Roundup)/County agency, provides law enforcement services for an estimated 4,100 population. Additional officers are needed to provide adequate protection for Musselshell County residents (Sheriff Paul Smith, Musselshell County Sheriff's Department, personal communication, June 30, 1992). The 14-bed County jail, located in Roundup, is an antiquated facility that needs to be either renovated or replaced.

The Yellowstone County Sheriff's Department provides law enforcement for an estimated population of 113,419 including the unincorporated communities of Huntley and Shepherd. More officers are needed for this area (Captain Richard Brennan, Yellowstone County Sheriff's Department, personal communication, June 30, 1992).

The Billings Police Department provides law enforcement services to an estimated population of 81,000. The department is understaffed and needs more officers to provide adequate law enforcement services to the city (Captain John Hall, Billings Police Department, personal communication, June 30, 1992).

All fire departments in the study area, except for Billings, are volunteer organizations. The Musselshell County Rural and Roundup Fire Department has an adequate number of volunteers and firefighting equipment for existing demand (Duane Brewer, Musselshell County/Roundup Fire Department, personal communication, July 1, 1992).

The Bull Mountains Volunteers, an initial-attack firefighting unit in Musselshell County, was organized in 1988 to provide additional fire protection in the Bull Mountains area. Although there are enough volunteers, firefighting equipment is limited.

The Broadview and Shepherd Volunteer Fire departments have sufficient volunteers and equipment to serve the existing population (Robby Badgett, Broadview Volunteer Fire Department, personal communication, July 7, 1992; Laura Vanberg, Shepherd Volunteer Fire Department, personal communication, July 1, 1992).

The Huntley Fire Department has 4 to 5 volunteers--not enough to provide sufficient fire protection to the community (Steve Erb, Huntley Volunteer Fire Department, personal communication, July 7, 1992). Huntley's firefighting vehicles and equipment are limited and in poor condition. In addition, the fire department is not properly equipped to provide year-round fire protection and volunteers are not trained to fight structural fires. Huntley and Worden fire departments share an emergency telephone number and maintain a mutual aid agreement (Yellowstone County Planning Department 1991).

Billings has 6 fire stations to provide fire protection to various areas of the city, but, in general, not to the rural areas surrounding Billings. Billings Fire Station #6 would respond to fires or provide equipment in Shepherd since they maintain a mutual aid agreement with the Shepherd Fire Department and all Billings fire stations would respond to wildland fires if requested by Montana DSL (Lonnie Larson, Billings Fire Department, personal communication, June 30, 1992).

5. Ambulance Services

The Musselshell County Ambulance Service in Roundup provides on-the-ground ambulance service to an estimated population of 4,100 and responds to an average of 25 emergency calls a month. The Musselshell County Ambulance Service is staffed by an adequate number of volunteers. The ambulances are high-mileage vehicles and probably should be replaced (Marion Ferguson, Musselshell County Ambulance Service, personal communication, June 30, 1992).

Broadview, Shepherd, and Huntley have no ambulance service available other than Billings. There are 3 on-the-ground ambulance and 2 air ambulance services in Billings, a sufficient number to provide appropriate emergency care to Billings and the surrounding area.

6. Housing

Year-round housing units in Musselshell County, including the Bull Mountains area, increased 9 percent between 1980 and 1990, from 1,997 to 2,183. Although the number of occupied units remained stable through the 10-year period, vacant housing units increased by 75 percent, from 299 to 522. Rental vacancy rate was 20 percent in 1990 (U.S. Department of Commerce 1991).

In 1990, there were 1,006 year-round housing units in Roundup, with 78 percent occupied (U.S. Department of Commerce 1991). Three-quarters of the homes were classified as one-unit structures and 80 percent were valued at less than $50,000.

Similar to Musselshell County, year-round housing units in Yellowstone County increased between 1980 and 1990 from 42,689 to 48,781, with vacant housing units increasing by 46 percent. Rental vacancy rate was 10 percent in 1990 (U.S. Department of Commerce 1991). In Billings, year-round housing units increased by 28 percent, with a 62 percent increase in vacant housing units.

The Billings Multiple Listing Service, which provides a listing of homes within a 70-mile radius of Billings, had 519 residential listings as of June 22, 1992, of which an estimated 45 were outside of Billings (Sue Anders, Billings Multiple Listing Service, personal communication, June 30, 1992). The Billings housing market has been very active and fewer homes are on the market than during the last few years (Charles Yegen, Peter Yegen Jr., Inc., personal communication, July 1, 1992; Jacque Stannebein, Landmark Realtors, personal communication, July 2, 1992; Sue Anders, pers. comm., June 30, 1992).

Rental units in the Billings area are expensive and difficult to locate. When apartments or houses become available, they are rented almost immediately (Charles Yegen, pers. comm. July 1, 1992; Jacque Stannebein, pers. comm., July 2, 1992).

Billings has a large supply of mobile home spaces (3,026 licensed mobile home and 353 recreational vehicle (RV) or tent spaces), while the smaller communities of Roundup (67 mobile home and 3 RV spaces), Broadview (12 mobile home spaces), Shepherd (6 mobile home spaces), and Huntley (14 mobile home spaces) have a limited supply (Montana Department of Health and Environmental Sciences 1992).

Billings has many motels to provide temporary housing (2,679 licensed motel/hotel rooms), whereas Roundup and Broadview have few (54 and 6 rooms, respectively) (Montana Department of Health and Environmental Sciences 1992).

7. Educational Facilities

Public schools in the Yellowstone County area include Broadview, Shepherd, Huntley Project (located in Worden), and Billings. Roundup School District is in Musselshell County. Broadview School District is situated in 3 counties--Yellowstone, Musselshell, and Stillwater.

Roundup School District maintains 2 school buildings--Central Elementary School (kindergarten through grade 6) and Roundup Middle/High School (grades 7 through 12). Roundup school enrollment has remained fairly stable since 1988, decreasing from 709 students in 1988 to 689 students in 1991. Based on current enrollment figures and new accreditation standards to become effective July 1, 1992, the elementary school is at capacity; however, seventh and eighth grade classes could accommodate 25 additional students and high school classes could enroll 20 more students before reaching capacity (Superintendent Jay Erdie, Roundup School District, personal communication, July 1, 1992).

Broadview School District maintains 1 school building serving students in kindergarten through grade 12. School enrollment of Broadview School District has fluctuated little between 1988 and 1991. School enrollment in 1991 was 70 students in kindergarten through grade 8 and 40 in grades 9 through 12. Overcrowded conditions currently exist at Broadview School (Superintendent Dan Nelsen, Broadview School District, personal communication, July 1, 1992).

Shepherd School District has 4 school buildings serving students in kindergarten through grade 12. School enrollment increased 7 percent between 1988 and 1991. During this period, enrollment in the lower level grades increased, while enrollment in the high school decreased. Shepherd Elementary Grade School is crowded even though a vacated cafe next to the school was purchased and converted into classroom space, and the high school will near capacity within 2 years (Superintendent Calvin Spangler, Shepherd School District, personal communication, July 2, 1992).

Huntley Project School District maintains 3 school facilities in Worden--an elementary school (kindergarten through grade 6), a middle school (grades 7 and 8), and a high school (grades 9 through 12). School enrollment decreased 5 percent between 1988 and 1991, from 698 to 662 students. The elementary grade school is filled to capacity, but the upper level grades could accommodate increased enrollment even though there has been a recent increase in seventh and eight grade enrollment (Ramona Stout, Huntley Project School, personal communication, July 1, 1992).

Billings School District #2 consists of 24 elementary schools, 4 middle schools, and 3 high schools. Between 1988 and 1991, school enrollment remained fairly stable. In school year 1991, there were 10,854 students in kindergarten through grade 8 and 4,723 in grades 9 through 12.

8. Human Services and Health Care Facilities

State, Federal, and County funding support social welfare services in Musselshell County. The County-administered welfare program provides Aid to Families with Dependent Children, Food Stamps, County Assistance (general and medical), and Medicaid. Caseloads in the Roundup office have increased dramatically over the past couple years, growing to a higher average level than formerly experienced during peak caseload months (January, December, and February). The current number of staff is not adequate to dispense the required services in a timely manner (Boni Braunbeck, Musselshell County Human Services, personal communication, June 30, 1992).

Two general practitioners, 1 dentist, and 1 optometrist provide health care services in Roundup. Roundup Memorial Hospital is the only licensed hospital within Musselshell County. Two physicians from Roundup and 12 physicians from Billings have doctors' privileges to provide health care services at the hospital (Max Long, Roundup Memorial Hospital, personal communication, June 30, 1992). In 1991, the 17-bed hospital had an occupancy rate of 7.5 percent (Gary Rose, Montana Department of Health and Environmental Sciences, personal communication, June 29, 1992).

Musselshell County Mental Health Center and Musselshell Chemical Dependency Center share an office in Roundup. The Mental Health Center provides counseling to the chronically mentally ill. The Musselshell Chemical Dependency Center provides out-patient counseling, referrals for in-patient care, and mandatory classes to driving-under-the-influence offenders.

No licensed physicians have health practices in Broadview, Shepherd, or Huntley. Billings has 308 licensed physicians employed in a variety of medical practices (Carol Norling, Montana Department of Commerce, Professional and Occupational Licensing Bureau, personal communication, June 30, 1992).

There are 2 hospitals in Billings--Deaconess Medical Center and Saint Vincent Hospital and Health Center. The 280-bed Deaconess Medical Center had an occupancy rate of 64.5 percent in 1991, while St. Vincent Hospital, also a 280-bed facility, had an occupancy rate of 71.0 percent in 1991 (Gary Rose, pers. com., June 29, 1992). The Billings area also has a number of businesses providing mental health and chemical dependency counseling.

9. Social Well-being

The social and economic character of Roundup and the surrounding area has evolved in conjunction with ranching, coal mining, and oil production. These have been the dominant sources of employment and income for Roundup area residents. Historically, the Roundup area economy has followed a "boom/bust" pattern, starting with the cattle industry in the 1880s and extending through the coal mining and oil development periods. Many area residents' social values, perceptions, and lifestyles have been influenced by the cyclic nature of good economic times followed by economic recession.

The ways in which people identify and respond to one another in Roundup are typical of small western towns--informal and personal. Residents know almost everyone in town and are aware of individuals' character, occupation, and socioeconomic status. The small town atmosphere, the quiet and predictable pace of life, and mutually supportive networks of family and friends are valued by residents.

In recent years, the Bull Mountains area has experienced an influx of people seeking the seclusion, scenery, and relatively pristine natural surroundings of the area. Many Roundup residents have termed these newcomers "mini-farmers" because they have purchased small acreages and have small numbers of livestock. It is perceived by Roundup residents that Bull Mountains residents are becoming somewhat of a social, political, and economic influence because they are organizing to reflect their specific interests, such as the Bull Mountains Landowners Association and Bull Mountains Volunteers.

The effects of proposed mine development on the social life of Roundup and Bull Mountains residents are apparent within the area. Some people have become polarized based upon their support or opposition to the Project. Roundup residents tend to favor new coal development, whereas the ranchers and Bull Mountains "mini-farmers" are perceived by Roundup residents to oppose it, even though the majority of Bull Mountains residents reported in a survey that they were not opposed to the mine. Social interaction between the "pro" and "anti" factions has become strained because of the relatively high degree of emotion associated with coal development (Economic Consultants Northwest 1989).

Broadview, the smallest incorporated town in Yellowstone County, evolved as an agricultural community and railroad loading site for agricultural and livestock commodities. Local lifestyles are influenced by factors that affect agricultural productivity and economics, such as amount of rainfall and market prices. As with most rural Montana communities, the agricultural lifestyle fosters strong ties between the people and the land (Montana Department of Natural Resources and Conservation July 1974).

Agriculture tends to produce its own subculture--work is physically hard, economically risky, and few times of the year can an operation be left to fend for itself. Broadview residents describe factors they like most about the area as being the quiet and small town environment, wildlife, open spaces, sparse population, and clean, fresh air.

Passage of the Carey Land Act in 1894 led to the development of extensive irrigation projects in the Shepherd/Huntley area, with settlers moving in to farm the land. The Huntley area was not developed until after 1904 because the area south of the Yellowstone River was part of the Crow Indian Reservation. Early homesteaders brought a diversity of cultures from Europe and Scandinavia and have contributed to the ethnic history of the area.

Social life throughout the Shepherd/Huntley area is typical of rural and small town areas of Montana. Farming and ranching families, many descendants of original settlers, provide a dominant social influence. Lifestyles and patterns of social interaction reflect traditional values and are characterized by strong interpersonal bonds based on shared ideas, trust, tradition, and community activities.

Area residents value the quiet, rural environment with open spaces, clean air, and a diversity of wildlife. Although people in the area value independence and low population density, extensive social interchanges are important elements of their lifestyles.

According to some local residents, past use of the existing Montana Rail Link low-volume coal loadout facility in Huntley (see Appendix B) has impacted the community. For a few months in 1990, coal was hauled from the proposed mine area to the Huntley loadout. In a recent survey (Economic Consultants Northwest 1991), 92 percent of the respondents indicated that they were aware that coal was hauled to the loadout facility and 43 percent of these respondents said they were affected by the Project. Coal dust, noise, safety of children due to increased traffic, highway deterioration, and the intrusion of the Project into residents' daily lives were concerns identified by the respondents as a result of the operation of the loadout facility in 1990. Since that time a group of Huntley residents has organized a subcommittee of the Huntley Community Club to oppose the Project.

Seasonally, trucks haul sugar beets to a stockpile facility in Huntley (see Appendix B). Residents generally have not voiced concerns about the hauling of sugar beets similar to those expressed about the proposed coal truck traffic.

K. RECREATION

Within Roundup and the immediate vicinity, outdoor recreation facilities include a 9-hole golf course, tennis courts, swimming pools, baseball fields, a community center (gymnasium), a large campground with over 50 sites, and a community park. Visitor use at the campground averages 3 sites per night but the campground fills to capacity for short periods during summer when special events draw visitors to town (Gayna Smiedala, Roundup Chamber of Commerce, personal communication, January 30, 1992). Golf course use averages 800-950 non-members and 200-225 members, annually. Use is light to moderate except for occasional weekends (Monty Sealy, Roundup Chamber of Commerce, personal communication, March 4, 1992).

The majority of Roundup and Bull Mountains residents participate in dispersed outdoor recreation activities including hunting, fishing, camping, walking, and horseback riding. Some of these activities take place in the Bull Mountains. However, most land in the Bull Mountains is privately owned, providing limited access for recreational pursuits.

Sections of Federal (BLM) land are generally isolated from each other by privately-owned lands. No federally-managed campgrounds or parks are located in this area of the Bull Mountains.

Deer harvest records indicate that hunting activities in the Bull Mountains area (Hunting District 590) have steadily increased over the past 5 years (Montana Department of Fish, Wildlife and Parks n.d.). Elk and antelope hunting is also available to a limited extent but hunting is controlled by an established permit system. Big game hunting season opens about the middle of October and runs through Thanksgiving weekend.

Fishing pressure is generally very light along the Musselshell River where most fishing occurs. Private stock ponds also provide fishing opportunities to a limited degree (Jay Newell, Department of Fish, Wildlife and Parks, personal communication, March 6,1992).

A total of 450 acres have been developed into 78 parks in Billings. An additional 918 acres are yet to be developed into 4 parks outside the city limits (Gene Blackwell, Billings Recreation Division, personal communication, January 30, 1992). Yellowstone County has developed an additional 53.9 acres into 74 parks (Cumin Associates 1984).

Huntley operates and maintains a 6-acre community park. Development within this park includes playground equipment, a basketball court, baseball diamond, and picnic facilities. Dispersed activities occurring in the community involve walking, jogging, and bicycling. Many residents of Huntley are retired and participate in these activities on a daily basis (Jim Pope, President of the Huntley Community Club, personal communication, January 30, 1992).

L. LAND USE

According to County comprehensive plans, about 1 percent of the land in Musselshell County and about 3 percent of the land in Yellowstone County is urban or urban built-up area. The remaining land is primarily agricultural, including rangeland, forest areas (forest cover and commercial forest), cropland, and pastures. There are also limited areas of rural/suburban tracts. Very little of the land area of either county is currently mined. Land in the Bull Mountains Project area is primarily forest and cropland, with some rangeland and rural/suburban tracts.

Land uses of the proposed life-of-mine area, rail spur, and transmission line include rangeland, cropland, coal mining, timber production, wildlife habitat, and recreation. Table III-4 provides a breakdown of existing land uses for the proposed life-of-mine area. The proposed Huntley loadout would be located in an existing rail-serviced industrial area.

1. Mineral Resource Development

PM Mine is currently permitted to mine coal in the western portion of the proposed life-of-mine area. Appendix B provides a full description of the PM Mine. Adjacent to the southeast is the reclaimed Meridian test pit area (see Figure B-1, Appendix B). The PM Mine and Meridian coal test pit cover about 202 acres of land, or 1.9 percent of the total life-of-mine area. About 71 acres of this land are currently used for livestock grazing.

2. Public Utilities

The only utility lines in the proposed life-of-mine area are those that serve the few scattered residences, ranches, and the PM Mine. There are no major transmission or pipelines in the proposed life-of-mine area.

The proposed 69 kV Fergus Electric Company power transmission line, planned to serve the proposed mine, can be divided into 2 sections. The first is a 10-mile upgrade from the Montana Power Company substation at Roundup, south to the South Roundup substation. The second is a 7-mile extension from the South Roundup substation south and east to the proposed mine (see Figure I-2). The first section is located in an existing easement that generally parallels U.S. Highway 87. The second section follows U.S. Highway 87 south for 2 miles then traverses a combination of agricultural, timberland, and grasslands to the mine area.

There are 2 oil and gas pipelines that cross the proposed rail spur right-of-way from northwest to southeast. The first is located about 8 miles east and the other 16 miles east of the west terminus of the rail spur. The first easement is owned by Continental Pipeline Company and the second by Glacier Pipeline Company.

One power transmission line tower, owned by Montana Power Company, is located adjacent to the rail spur about 4 miles east of its west terminus. From this point, the transmission line runs eastward along the rail spur's south right-of-way line for about 2 miles.

TABLE III-4
Bull Mountains Mine No. 1 Life-of-Mine Area Land Use Acreages

	ACREAGE OCCUPIED	PERCENT OF TOTAL AREA
1. Residential/fish and wildlife habitat/ recreation	438	4.0
2. Cropland/grazing land	17	0.2
3. Grazing land/fish and wildlife habitat/ recreation	9,944	91.6
4. Special-use pasture/fish and wildlife habitat/recreation	262	2.4
5. Grazing land/fish and wildlife habitat/ industrial/commercial	50	0.5
6. Special-use pasture/fish and wildlife habitat/industrial/commercial	21	0.2
7. Industrial/commercial	109	1.0
8. Developed water resources	15	0.1
	10,856	100.0

Source: Meridian Minerals Company 1989-1992.

3. Livestock Grazing/Agricultural Land

Approximately 10,294 acres, 94.8 percent of the life-of-mine area, are used for livestock grazing, mainly cattle and some horses. About 17 of these acres, north of the PM mine, are primarily used to grow alfalfa or wheat and are used secondarily as grazing land. Although there are no areas set aside solely for use as wildlife habitat, 10,715 acres of the life-of-mine area do provide wildlife habitat (see Table III-4). There are a total of 49 springs in the life-of-mine area. Four of these, Busse, Cold Water, Litsky, and Black Canyon are highly important to livestock grazing and wildlife, 14 are moderately important, 24 have a low importance, and 7 have a negligible importance (see Table III-3).

The proposed rail spur traverses a variety of agricultural uses. About 10 and one-fourth miles of the east end is primarily grazing land with ponderosa pine cover. The remaining right-of-way is primarily fields of small grains, hay, wheatgrass lowlands, alkali/salt grasslands, and conservation reserve lands. Conservation Reserve lands are lands that have temporarily been set aside under the Federal Conservation Reserve Program (CRP). The CRP is in effect to help owners and operators of eligible cropland conserve and improve soil and water resources by removing highly erodible or other eligible cropland from production. The CRP also curbs the production of surplus commodities, thereby increasing commodity prices received by farmers, improving water quality by reducing soil erosion, reducing sedimentation in streams and along roadsides, and enhancing fish and wildlife habitat. The owner and/or operator of the land is compensated for keeping the land out of production for the term of the agreement.

4. Other Land Uses

A portion of a dispersed housing subdivision, about 438 acres, is located in the north portion of the life-of-mine area. The subdivision is being developed by Yellowstone Basin Properties, Inc. About one-third of the available parcels have been sold; however, only 1 house has been built to date. There are several scattered, rural residences within one-half of the proposed 69 kV transmission line and the life-of-mine area. The proposed rail spur right-of-way would come within 300 to 400 feet of 2 ranch houses, and within one-fourth to one-half mile of several others.

The proposed Huntley loadout would be located in a rail-served industrial area in the southeast portion of Huntley (see Figure B-2). A sugar beet loading facility, rail yard, and grain elevator are immediately adjacent to the proposed loadout site. There are residential areas to the northeast, north, and northwest of the proposed site. The closest residence is within 500 feet of the site. To the west, within 1,000 feet of the proposed loadout, is the urban area of Huntley. Detailed descriptions of existing facilities and operations are in Appendix B.

M. VISUAL RESOURCES/AESTHETICS

The Bull Mountains area is characterized by wooded rolling hills and low mountains (the highest is Dunn Mountain with an elevation of about 4,750 feet) and open, flat, grass- and farmlands. In general, the region is a mix that combines areas with some outstanding visual features and some that are fairly common to the region. There are some areas of extensive cultural modifications including Roundup and Broadview, the PM Mine, Meridian's coal test pit and agricultural fields.

The proposed life-of-mine area is composed of hills and low mountains, interspersed by gently sloping valleys, with some upland grasslands, hayfields, ponderosa pine and rock outcroppings. There is a mixture of outstanding visual features, some that are common to the region, and some extensive modifications. The PM Mine has disturbed about 101 acres. The Snowy, Big Horn, Pryor, Beartooth, and Crazy mountains are visible from Dunn Mountain, the highest point of the Bull Mountains (over 1 mile south of the Musselshell-Yellowstone county line). The Crazy and Beartooth mountains are about 100 miles distant.

The proposed 33-mile rail spur runs from the proposed mine, on the east end, in a generally southwesterly direction to the Burlington Northern mainline, about 2 miles south of Broadview. A 6,800-foot siding would parallel the mainline south of its junction with the rail spur. The rail spur right-of-way varies from 150- to 500-feet wide and traverses land ranging from wooded hills and grassy valleys with some small, steep-sided canyons on the east end, to flat, open fields and lowlands on the west end. The east end is a mix of some outstanding visual features with some common to the region, while the west end is composed of features that are subtle, with little contrast, and common to the region.

The proposed transmission line would include 10 miles of upgraded line located in an existing easement that runs from Roundup, south to the Roundup substation, and 7 miles of newly-constructed line in a 50-foot right-of-way running south and east from the Roundup substation to the proposed mine. The line would travel through rolling hills and valleys with mixed pine and grasslands.

The Huntley loadout is located at an existing rail-served industrial area in the southeast corner of Huntley, adjacent to a sugar beet stockpile and loading area, grain elevator, and the Montana Rail Link tracks. There are residential areas to the northeast, north and northwest; the closest residence is about 500 feet from the proposed facility. The scenic quality of this area has been substantially impacted by cultural modifications.

All of the proposed facilities are located in areas whose visual/aesthetic features are a mix of some outstanding and some common features and areas whose features are fairly common to their physiographic region. There are no areas of special, critical, or unique scenic significance, and no national landmark sites on any of the proposed mine facility sites.

N. CULTURAL RESOURCES

1. Prehistoric and Historic Resources

Prehistoric resources are physical properties resulting from human activities predating written records, identified as either isolated artifacts or sites. Sites contain concentrations of artifacts (e.g., stone tools and ceramic shards), features (e.g., campfires and tipi rings), and plant and animal remains. Depending on their age, complexity, integrity, and relationship to one another, sites may be important and capable of yielding information about past cultures and settlement patterns. Prehistoric site types in the Bull Mountains area include campsites, cribbed log structures, limited activity sites, rock art, rock cairns and quarries, and workshops.

Historic resources consist of physical properties that postdate the existence of written records and include architectural structures (e.g., log cabins, dams, and bridges) and archaeological features such as foundations, trails, and trash dumps. Such resources may have research potential in the same manner as prehistoric sites, but historic sites are more often considered important because of their association with important historical persons or events, or as examples of distinctive architectural styles.

The active disturbance area, including the facilities area, haul roads, and the railway corridor, was surveyed at a high-intensity (Class III) level. The balance of the life-of-mine area was surveyed for rock art and standing structures since controlled subsidence should not materially disrupt subsurface materials. Steep slope areas where subsidence could disrupt subsurface deposits have been identified. These will be surveyed at the Class III level in advance of mining and any new sites evaluated and mitigated as required.

Thirteen sites (10 lithic scatters, a homestead, a stone circle site and a prehistoric/historic site) have been found in the proposed life-of-mine area (Rood 1990; Tetra Tech, Inc. 1991). Five prehistoric lithic scatters and the stone circle site were recommended as potentially National Register of Historic Places (NRHP) eligible pending additional testing (Rood 1990; Tetra Tech, Inc. 1991). Seven sites have limited research potential and are not considered eligible for the NRHP.

Several additional sites have been located throughout the life-of-mine area but have not been fully recorded or evaluated for NRHP eligibility. Other undiscovered sites doubtless occur within the life-of-mine area. Some of these will probably prove to be NRHP eligible. Areas with the highest probability for prehistoric and historic sites would be near springs, or along ridge tops with southern or eastern exposures (Rood 1990). Except in the steep slope areas noted above, no disturbance of these sites is anticipated.

Fifteen prehistoric lithic scatters, 23 historic sites (a school site, 13 homesteads, and 9 trash scatters) and 1 prehistoric/historic site have been found in and around the proposed rail spur corridor (Pool 1991; Tetra Tech, Inc. 1991). Thirty-one of these sites (13 prehistoric lithic scatters and 18 historic sites) have been recommended NRHP eligible or potentially eligible pending additional testing or archival research. Eight sites have limited research potential and are not considered NRHP eligible.

No prehistoric or historic sites have been found along the proposed transmission line corridor or the Huntley loadout facility (Husted 1989; Wood 1990).

2. Native American Resources

Native American (traditional) resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Sensitive resources may include some types of prehistoric sites, features and artifacts, contemporary sacred areas, traditional use areas (e.g., native plant habitat), and sources for materials used in the production of sacred objects and traditional tools.

Native American groups with traditional ties and concerns in the Bull Mountains area include the Crow, Blackfeet, GrosVentre, Sioux, Northern Cheyenne, Assiniboine, Shoshone, and Arapaho. Several areas that may contain resources sensitive to these groups have been located in the area. Sensitive site types may include vision quest sites, large rock features, rock art sites, burials, ceremonial structures, and dance grounds (Deaver 1986). Sensitive places in the area may include mountain peaks or springs.

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

This chapter contains the Agency's analysis of probable impacts to the human environment that would result from construction and operation of the proposed Bull Mountains Mine No. 1, its coal transportation system, and associated support facilities (the Project). It also contains the analysis of probable cumulative impacts that would result from adding the proposed activities to other existing and reasonably foreseeable activities in the Billings-Huntley-Roundup-Broadview area.

In order to perform the impact analysis contained in this chapter, certain assumptions were made. The following assumptions are for the purpose of this analysis only. They were not intended to be the final projection of future activities that may or may not materialize in the area over the next 44 years.

A. IMPACTS OF ALTERNATIVE 1

1. Assumptions for Alternative 1

Assumptions used by the Agency to perform the impact analysis for Alternative 1 include:

- The permit application package submitted by Meridian for operations associated with Bull Mountains Mine No. 1 with conditions attached, is in compliance with Montana Strip and Underground Mine Reclamation Act (MSUMRA) and other applicable State and Federal laws.

- Mining and reclamation technology would not change substantially throughout mine life.

- Labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development.

- Impacts to coal supply or demand (regional or otherwise) are beyond the scope of this EIS.

- The life of the mine would be 44 years: 3 years for pre-mining development, equipment erection, and limited coal production; 30 years for active mining; 1 year for facility demolition and final reclamation; and a minimum of 10 additional years for bond release after seeding, fertilizing, irrigation, or other work to ensure revegetation was complete (see Table I-2). The life of the temporary loadout at Huntley would be 4 years: 2 to 3 months for upgrading the facility, 2 to 3 years for active loadout operations during early development at the mine, and 6 to 9 months for facility demolition, final reclamation and bond release. The life of the rail spur would be 34 years: 3 years for construction, 30 years for use during active coal hauling, and 1 year for decommissioning and limited reclamation. The term of the construction and operation activities considered in the cumulative analysis would be as specified in Appendix B.

- The Project as described in Appendix A would be initiated in late-1992 or early-1993.

- Reclamation would be initiated when an area was no longer needed for either mining or production operations. No reclaimed acres would be available for postmining land use until the end of mine life. Postmining land use at the Huntley loadout would begin after final bond release.

- The local short-term impacts of the Project are those that would occur during the period from premining development through bond release (i.e., 44 years at the mine and 4 years at the Huntley loadout). Long-term impacts of the Project are those that would persist beyond final bond release. For construction and operation activities considered in the cumulative analysis, short-term impacts are those that occur during the term of the respective activities. Long-term impacts are those that would persist beyond the terms of these activities as indicated in Appendix B.

- An irreversible and irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the Project. The commitment of a resource would be "irreversible" if the Project started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever.

  Commitment of a resource would be considered "irretrievable" when the Project directly eliminated the resource, its productivity, and/or its utility for the life of the Project.

- Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impact to the human environment. The terms "major," "moderate," "minor," and "negligible" describe magnitude.

"Significant," "potential to become significant," and "insignificant" describe importance. Impacts are assumed to be insignificant unless identified otherwise.

- Cumulative impacts are defined as collective impacts of the Project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Appendix B.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

- The geographical limits for the analysis of probable impacts in this EIS primarily encompass the life-of-mine area, the railroad corridor, the powerline corridor, areas designated for hydrological mitigation outside the life-of-mine area, and the life-of-operation areas for associated development facilities located in the Billings-Huntley-Roundup-Broadview area. Where larger geographical limits were established to allow for required analyses and assessment of impacts, a description follows:

  Geology. The geologic study area is a region within the Bull Mountains basin defined by surface outcrops of the Fort Union Formation, specifically, the Tongue River Formation.

  Vegetation. For the rail corridor, the study area included a 1- to 2-mile band along the 30-mile corridor. This area encompasses about 40,000 acres.

  Wildlife. The wildlife study area includes the proposed life-of-mine area plus a 3.2 km (2 mile) buffer zone. This larger area was intended to reflect the limits within which wildlife would be influenced by a fully developed project. For the rail corridor, the study area included a strip of land about 1 and one-half to 2 miles wide along the entire corridor.

  Transportation. The study area is bounded by existing highway systems and the proposed rail spur in Musselshell and Yellowstone counties. Roadway segments defining the study area are: Fatting Creek Road, Old Divide Road, U.S. Highway 87, Highway 312, Montana Route 3, and Heath Street in Huntley.

  Socioeconomics. All of Yellowstone and Musselshell counties, the incorporated municipalities of Roundup, Billings, and Broadview and the unincorporated communities of Shepherd and Huntley are included in the study area.

Recreation. For recreation, the study area is bounded by Roundup on the north and Billings on the south with the proposed mine and Broadview being the east and west boundaries, respectively. In general, the study area encompasses a radius of about 50 miles.

Visual Resources. The visual study area includes all lands within 5 miles of, and with a direct line-of-sight to, mine-related facilities and activities.

- The employment assumptions for the economic analysis include: Meridian would be able to hire 75 percent of the direct mine-related employment from the available work force in the Billings labor market area, which includes Roundup, Broadview, Huntley, and Shepherd.

- An employment multiplier of .45 represents the number of secondary jobs created for each direct mine-related job.

- Ninety percent of all secondary employees would be hired locally.

- Demographic assumptions include: The average family size for mine-related employees would be 3.1 persons per family while secondary and construction employees would have an average family size of 2.1 persons per family.

- In-migrating workers would relocate within the study area as follows:

    - Seventy-four percent to Billings.

    - Thirteen percent to Roundup.

    - Seven percent to rural Yellowstone County.

    - Six percent to rural Musselshell County.

- Forty-five percent of the in-migrating children would be enrolled in grades kindergarten through 8th grade, 19 percent would be enrolled in high school, and 36 percent would not be enrolled in school.

- Income assumptions include: The average annual salary for jobs directly related to mine activities would be $33,309. The average annual salary for secondary workers would be $15,397. Both of these averages are based on the statewide average salary paid to mining and service sector employees in 1990.

- Fiscal assumptions include: Local government mill levies would remain at 1990 levels for the life of the mine. State funding and equalization for local school districts would not change for the life of the mine.
- The contract sales price of coal would average $15 per ton (1989 dollars) for the life of the mine.

2. Air Quality

a. Impacts to air quality in and around the surface facility complex from mining-related activities.

Major emissions during the construction, mining, and reclamation phases of the Project would be from generation of fugitive dust. The principal sources of fugitive dust would be from activities related to: land clearing; earthmoving; drilling and blasting; truck and/or train loading operations; wind erosion from coal, soil, and spoil stockpiles and conveyors; coal-handling operations; and vehicle traffic on unpaved haul roads. Dust generated from these open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream (e.g., stack, chimney, or vent).

The air quality impact of a fugitive dust source depends on the quantity and drift potential of the dust particles injected into the atmosphere. The larger dust particles settle out near the source (often creating a local nuisance problem), while a considerable amount of fine particles are dispersed over much greater distances. Theoretical drift distances, as a function of particulate diameter and mean wind speed, have been computed for fugitive dust emissions. For a typical wind speed of 10 miles per hour (MPH), particles larger than 100 micrometers (μm) are likely to settle out within 20 to 30 feet from the source. (For comparison, a human hair has a thickness of 100 μm.) Particles 30 to 100 μm, depending on the extent of atmosphere turbulence, are likely to settle within a few hundred feet. Dust particles smaller than 30 μm are generally recognized as emissions that may remain indefinitely suspended.

Current State and Federal ambient air quality standards for particulate matter include only particles with a diameter less than or equal to 10μm (PM_{10}) because those are the particles that penetrate into the windpipe, upper lung, and deep lung (alveolar) regions of the respiratory tract. Even though the biological response of individuals differs, particle penetration to these areas poses the greatest health risk. Because of the low risk of adverse health impacts from deposition of larger particles in the respiratory passages of the head, particles over 10μm were excluded from the standard. Montana PM_{10} standards are shown in Table III-2.

Other pollutant emissions would include exhaust emissions from diesel-powered construction equipment, trucks, and other motor vehicles, and stack or ventilation emissions from the mine, boiler, and coal preparation and clean coal processing plant. Pollutants from these sources would include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulates (PM_{10}).

Maximum Project-related 24-hour average PM_{10} impacts near the life-of-mine boundary during full coal production would range from about 3 to 79 $\mu g/m^3$. These PM_{10} concentrations equate to Total Suspended Particulate (TSP) concentrations of about 5 to 132 $\mu g/m^3$. These maximum concentrations are higher than concentrations typically found near the boundary. Greater impacts would occur on days that have light winds and poor dispersion conditions (temperature inversion). These conditions normally occur during winter in the early morning hours. Annual PM_{10} impacts at the life-of-mine boundary would range from 0.2 to 7 $\mu g/m^3$.

Total 24-hour average PM_{10} impacts (Project concentrations plus background concentrations) would range from 56 to 132 $\mu g/m^3$ near the life-of-mine boundary. Annual PM_{10} concentrations would range from about 9 to 16 $\mu g/m^3$. These concentrations would be well below Montana PM_{10} Ambient Air Standards (see Table III-2).

Air quality would occasionally be degraded by Project particulate concentrations in excess of the allowable 24-hour average Prevention of Significant Deterioration (PSD) Class II incremental TSP concentration of 37 $\mu g/m^3$. Particulate increment requirements are not applicable for the mine because estimated particulate emissions would be about 115 tons per year. A PSD permit would be required only if there were annual emissions of 250 tons or more from mining operations.

Gaseous pollutant concentrations (NO_2, CO, SO_2) would not exceed Montana Ambient Air Standards and air quality degradation by NO_2 and SO_2 would be less than the applicable PSD Class II increments.

In order to minimize air quality impacts from particulates, the following dust controls would be used, (for additional details, see Appendix A):

- Particulate emissions from the coal dryer would be controlled with a bag-house;
- Conveyors outside the mine portal would be partially enclosed. Water sprays would be used to minimize dust generation from the conveyors at transfer points;

- Coal stockpile feed conveyors would be equipped with variable tube stackers to minimize the fall distance to the pile and control spillage;
- Open coal stockpiles would be sprayed with water, as necessary;
- Coal crushing equipment would be equipped with water sprays;
- Water or other approved dust suppressants would be applied to active roadways and parking areas, as needed;
- Coal, rock, soil, and other dust-generating material would be promptly removed from all roads;
- Speed would be limited to 25 MPH on all roads within the mine property;
- Yard areas and parking lots would be graveled;
- Disturbed areas susceptible to potential fugitive dust emissions would be revegetated, mulched, or otherwise stabilized; and
- Topsoil and subsoil storage stockpiles would be revegetated as soon as possible after they were established.

The Agency concludes that impacts to air quality in and around the surface facility complex from mining-related activities would be minor over the short term and negligible over the long term.

b. Impacts to air quality along and around the rail spur from mining-related activities.

Direct emissions would result from construction of the rail spur, operation of coal trains, and reclamation activities. Fugitive dust would result from activities related to land clearing, earth moving, and vehicle traffic on unpaved roads. Fugitive coal dust emissions would come from the coal cars when trains passed. Exhaust emissions from diesel-powered construction equipment, trucks, other motor vehicles, and diesel locomotives would include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulates.

Daily pollutant emission rates for rail spur construction and coal train operations are presented in Table IV-1. In order to estimate regional or County impacts, Musselshell County emissions were used since that is where most of the rail spur would be located (see Table IV-1). Emissions include those from fuel combustion in stationary sources, transportation, solid waste disposal, and industrial processes. The transportation category includes automobiles, trucks, buses, and trains (e.g., Burlington Northern trains). As shown in Table IV-1, particulates from rail spur construction would have the highest pollution rate. However, the increase in the County

TABLE IV-1

Comparison of Rail Spur Construction and Coal Train Operations Pollutant Emissions With Musselshell County Emissions

Pollutant	Musselshell County Emissions[1] (lb/day)	Rail Spur Construction Emissions[2] (lb/day)	% Increase in County Emissions	Coal Train Emissions[2] (lb/trip)	% Increase in County Emissions
CO	12,707	81.6	0.64	87.9	0.69
NO_x as NO_2	3,616	134.1	3.6	250	6.5
SO_x as SO_2	395	15.5	3.8	38.5	8.9
Particulates	109,425	1,058[3]	0.96	16.9[4]	0.02

Notes: [1] Source: National Emission Data System (Farrel 1992).
[2] Emission factors: EPA Document AP-42 (EPA 1985).
[3] Includes exhaust and fugitive dust emissions.
[4] Does not include coal dust.

particulate burden from the proposed Project would be only 1 percent. NO_2 and CO emissions from rail spur construction would each add about 4 percent to the County pollutant burden.

Local, temporary increases in pollutant concentrations, especially fugitive dust (PM_{10}), could occur a few hundred feet downwind from railroad construction sites. When construction activities ended, pollutant concentrations would return to near background levels.

Operation of coal trains would produce an increase in County SO_2, NO_2, and CO pollutant burdens and temporary increases in downwind concentrations of pollutants emitted in the exhaust of the diesel locomotives (see Table IV-1). At a residence located 500 feet from the railroad spur, these concentration increases would be brief, and concentrations would quickly return to background levels. Even though some coal dust would be blown from coal trains, it was not possible to quantify the amount because emission factors have not yet been determined for dust blowing from coal trains.

In the Broadview area, the addition of 1 train per day to traffic currently on the Burlington Northern mainline would not cause an appreciable change in local pollutant concentrations.

During reclamation, emissions from the equipment and vehicles used to remove the ties, rail, and ballast would produce some fugitive dust and diesel exhaust emissions. These would produce some temporary increases in concentrations, up to a few hundred feet downwind.

During construction of the rail spur, construction areas would be watered to minimize fugitive dust emissions. Regular preventive maintenance would be performed to minimize gaseous pollutant emissions from the construction equipment and other vehicles due to engine problems. Good maintenance practices would also be used on the diesel locomotives.

The Agency concludes that impacts to air quality along and around the rail spur from mining-related activities would be minor over the short term and negligible over the long term.

c. Impacts to air quality from truck haulage of coal on U.S. Highway 87, Highway 312, and Heath Street.

Haul trucks would enter U.S. Highway 87 at its southern intersection with Old Divide Road. They would follow U.S. 87 south to the intersection with Highway 312, then east along the Highway 312 to Huntley. In Huntley, trucks would proceed south along Heath Street. These are all paved roads.

Direct air emissions would come from coal truck exhaust, particulate matter from wear of bearings and brake linings, abrasion of tires against the road surface and fugitive re-entrained traffic dust. Re-entrained fugitive dust consists primarily of common sand and soil, mostly tracked or deposited onto the roadway by vehicle traffic. Some of the direct emissions may settle to the roadway surface to be re-entrained. Re-entrainment rates are higher if the pavement surface has deteriorated. Some coal dust would escape during transport but could not be quantified since emission factors for coal dust from truck haulage were not available.

Daily emission rates for CO, NO_x, hydrocarbons (non-methane), and re-entrained dust are presented in Table IV-2. The percentage increases in Yellowstone County pollutant emissions that would result from hauling coal over the paved roads would be 0.1 percent or less (see Table IV-2). These small increases in pollutant emissions would contribute very little to the overall pollutant burden in Yellowstone County.

Local pollutant concentrations a few hundred feet downwind of the highway would increase briefly when a coal truck passed. These higher concentrations would quickly return to background levels after the exhaust plume passed a given downwind location.

TABLE IV-2

Comparison of Coal Truck Pollution Emissions
With Yellowstone County Emissions

Pollutant	Yellowstone County[1] (lb/day)	Project Coal Truck Emissions (lb/day)[2]	% Increase in County Emissions
CO	192,060	177.0	0.09
NO_x	96,263	138.8	0.14
Hydrocarbons	66,690	36.4	0.05
Particulates	208,904	99.8[3]	0.05

Note: [1] Source: EPA National Emission Data System, 1988 (Farrel 1992).
[2] Emission factors from EPA document AP-42 (EPA 1985).
[3] Re-entrained dust and exhaust particulates; coal dust from trucks not included.

Sometime after 1993, a 6.2 mile section of U.S. Highway 87, several miles south of the south end of Old Divide Road, is scheduled for reconstruction (see Appendix B). During the year of construction, cumulative traffic and truck traffic emissions downwind of this section of the highway would be higher than other areas adjacent to the haul route. The cumulative air quality effects would end upon completion of construction.

Coal dust emissions from haul trucks would be minimized by using tarps and/or special trailer designs, and limiting trucks to a maximum 15 mph on Heath Street in Huntley. Truck haulage would last for a 2- to 3-year period, after which pollutant concentrations would return to previous levels.

The Agency concludes that impacts to air quality from truck haulage of coal on U.S. Highway 87, Highway 312, and Heath Street would be minor to moderate over the short term and negligible over the long term.

d. Impacts to air quality in and around the Huntley area from construction, operation, and reclamation of the Huntley loadout.

Construction activities related to expansion of the Huntley loadout would produce fugitive dust and exhaust pollutants. During construction, pollutant emissions, especially fugitive dust, would move downwind and cause temporary increases in ambient concentrations a few hundred feet from the site.

Two major types of pollutant emissions, fugitive dust and coal dust, would come from operation of the loadout facility. Fugitive dust would be produced by truck travel on unpaved haul roads within the facility. Coal dust would be generated by coal dropping from trucks into bins, wind erosion from the stockpile and open conveyors, coal dropping from conveyors onto the stockpile and into rail cars, and bulldozing the stockpiles. Direct emissions of CO, NO_x, and particulates would occur from diesel equipment, trucks, and locomotives.

Predicted ambient pollutant concentrations, including Project impacts, background concentrations, and combined total concentrations are presented in Table IV-3. Table IV-4 describes the location of air quality monitoring receptors.

The predicted concentrations represent maximum values which would usually occur during the early morning hours when the winds are light and pollutant dispersion is at a minimum (temperature inversion). These worst case meteorological conditions usually occur during the winter and early spring. The average or typical concentrations would be lower than the values shown in Table IV-3. None of the total concentrations would exceed the Montana Ambient Air Quality Standards.

The maximum 24-hour PM_{10} concentration (37.6 $\mu g/m^3$), resulting from Project operations, indicates that the degradation of air quality would occasionally exceed the allowable PSD increment. The PM_{10} concentration of 37.6 $\mu g/m^3$ equates to a TSP concentration of about 63 $\mu g/m^3$. This concentration would be about 1.7 times the allowable PSD increment of 37 $\mu g/m^3$. None of the other Project pollutant concentrations would exceed the PSD Class II increment. PSD permit requirements would not be applicable to the facility because the estimated particulate emissions would only be about 12 tons per year.

Reclamation of the Huntley loadout would produce some fugitive dust and diesel exhaust emissions. Ambient pollutant concentrations would increase a few hundred feet downwind of the facility, during reclamation operations. Once reclamation was completed, pollutant concentrations would return to background levels.

In addition to pollutant emissions from the loadout, fugitive dust and exhaust emissions would occur from regular train traffic passing through the Huntley area, and from operation of the Huntley sugar beet loading site and grain elevator (see Appendix B). Sugar beets are stockpiled during October and hauled to the factory from October through January. Peak pollutant emission rates would occur in October with somewhat lower rates from November through January. Pollutant concentrations resulting from the combined operation of the 2 facilities would result in greater downwind air quality impacts from October through January.

TABLE IV-3

Summary of Predicted Maximum Ambient Concentrations for the Huntley Loadout Compared to Ambient Air Quality Standards and PSD Increments

Pollutant	Averaging Period	Receptor Identification[1]	Project Contribution ($\mu g/m^3$)	Background Concentration(2) ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	Montana Standard ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
PM_{10}	24-hour	2	37.6	41	79	150	37 (TSP)
	Annual	3	6.8	14	21	50	19 (TSP)
NO_2	1-hour	1	95.0	20	115	565	*
	Annual	3	0.4	2	2	100	25
CO	1-hour	1	99.3	1,100	1,199	26,300	*
	8-hour	1	9.4	770	779	10,000	*

Note:[1] See Table IV-4.
[2] Source: Conenberg 1992 and Urone 1976.
* No ambient PSD increment established by EPA.

TABLE IV-4

Location of Air Quality Monitoring Receptors Shown in TABLE IV-3

Receptor Identification	Map Description
1	About 700 feet west of the center of the proposed loadout facility, near Northern Avenue.
2	About 650 feet southwest of the center of the proposed loadout facility, near the grain elevator.
3	About 1000 feet northeast of the center of the proposed loadout facility near the Heath Street intersection.

To minimize fugitive dust emissions, a water spray system would be installed on the access roads and the coal stockpile (see Roads and Railroads, Appendix A). Coal would be transferred out of the pile belt conveyor through a reclaim tunnel and a flexible chute which would help control coal dust emissions as the coal fell into rail cars. After the 2- to 3-year period of loadout use, pollutant concentrations would return to previous levels.

The Agency concludes that impacts to air quality in and around the Huntley area from construction, operation, and reclamation of the Huntley loadout would be minor over the short term and negligible over the long term.

3. Geology

a. Impacts to the stability of slopes and sandstone cliffs in and around the life-of-mine area from mining-related subsidence.

Effects of subsidence from the proposed longwall mining in the Bull Mountains can be described by 3 impact zones (Appendix C). The fragmented zone, which would fracture and collapse, is expected to begin immediately above the active mining area and extend up to 140 feet above that area. The next zone, the fractured zone, is expected to extend 400 to 600 feet above the fragmented zone and would fracture and deform. The deformation zone extends upward from the fractured zone to the surface. In the deformation zone, the ground would be expected to deform without fracturing; cracks could develop at the surface. Most surface cracks are expected to weather and close during the first 2 years following subsidence.

Surface effects of subsidence depend on characteristics of the overburden as well as depth of mining below the surface, height of coal seam removed, mine layout, and mining direction. Meridian proposes to remove 13.5 feet of coal, and maximum subsidence is predicted to be 9.5 feet (Agapito and Maleki 1989; Allgaier 1988). The trough of subsidence (see Figure C-3) predicted for the proposed mining area would be deepest at its center, graduating to little or no subsidence at the ultimate boundary of coal removal.

Throughout a particular subsidence trough, slope failures and toppling of sandstone cliffs may occur. Slope instability and failure, rock toppling, and alteration to topography and drainage patterns have the greatest potential to occur where steep slopes, weathered materials, and unstable structural conditions exist over the subsidence trough.

Subsidence-related failures would accelerate the slower, natural processes of weathering, erosion, sloughing, and toppling in the area. Where mountains and hills overlie mining, and overburden is thick, surface effects of subsidence would be expected to be most evident at the bases and edges of steep slopes. Eventually, slopes would stabilize and natural conditions would determine the extent to which toppling and sloughing would occur in the future.

The Agency concludes that impacts to the stability of slopes and sandstone cliffs in and around the life-of-mine area from mining-related subsidence would be minor over the short term and negligible over the long term.

4. Topography

a. Impacts to topography of the surface facility complex from construction, mining, and reclamation activities.

Activities associated with construction and operation of the Project would impact the landscape and topography of the life-of-mine area. Elevations in a portion of the area of the existing PM Mine, near the portal, would rise about 60 feet as the result of backfilling and grading the existing open pit high wall. In the main facilities area, postmining topography eventually would be similar to adjacent premining topography. Flat areas expanded during mining would have runoff controlled through sediment ponds. Planned reclamation would restore the main facilities area and roads to approximate original elevations and contours, while maintaining topographic diversity (see Waste Disposal Area, Appendix A).

Filling the waste disposal area (WDA) would change the existing valley into a gentler mountain slope (see figures A-10 and A-11, Appendix A). Postmining topography in the WDA would rise from 0 to 140 feet as a result of filling from mining activities. Slopes, slope construction, and revegetation would be designed for maximum stability and the new drainages, channels, and floodplains in the WDA would be designed to pass runoff at velocities that would not cause erosion (see Storm Water and Sediment Control Facilities, Appendix A). During filling, topography would be interrupted by abrupt benches and incomplete slopes as the waste material was deposited and compacted. After filling, some benches would still be present on the face but postmining topography would generally blend with adjacent undisturbed topography.

The Agency concludes that impacts to topography of the surface facility complex from construction, mining, and reclamation activities would be moderate to major over the short term and minor to negligible over the long term. In the WDA, there would be an irretrievable loss of topographical diversity.

b. Impacts to topography in and around the life-of-mine area from mining-related subsidence.

Mining-related subsidence has the greatest potential to alter drainage patterns and impact slope stability where steep slopes, weathered materials, and unstable geotechnical conditions overlie the subsidence trough. The lowering of ground surface, sloughing of slopes, and related filling of drainages and alteration of drainage patterns, would be most evident around the bases of hills and mountains. Sloughing of slopes related to subsidence, and resulting changes, are an acceleration of natural topographic change in the life-of-mine area.

The Agency concludes that impacts to topography in and around the life-of-mine area from mining-related subsidence would be minor over the short term and negligible over the long term.

c. Impacts to topography along the rail spur from construction and reclamation activities.

Construction of the proposed 33-mile rail spur would introduce a permanent change in topography along the majority of the 150- to 500-foot wide right-of-way. Extensive cuts-and-fills would be necessary to meet the needs of the design grade. In addition to the elevated railbed, numerous road crossings, road relocations, and bridges would impact local topography during mine operation.

During proposed reclamation, rail ties and ballast would be removed, and the railbed would be abandoned in place throughout much of the 33-mile length. The abandoned, elevated railbed, steep side slopes, and extensive cut-and-fill slopes would permanently change topography along the rail spur right-of-way except on State-owned parcels. Existing gentle slopes and terrain would be changed to include the abrupt profile of the railbed and road crossings.

The Agency concludes that impacts to topography along the rail spur from construction and reclamation activities would be moderate over both the short and long terms.

5. Soils

a. Impacts to soil productivity in areas of mining-related surface disturbance.

Surface disturbances related to proposed mining and associated activities have the potential to change the productivity of disturbed soils in the life-of-mine area, and the locations of ancillary facilities, including the Huntley loadout. Productivity of topsoils and subsoils that are stripped and stockpiled may be altered. Soil structure and texture could be changed and biological activity and nutrient content may be reduced.

While soil salvage and stockpiling may have productivity-reducing effects on soils, reclamation activities may have productivity-increasing effects in some areas. Salvaged soils would be replaced so that they are more uniformly thick, and mixed so that they are more uniformly productive. Soils are replaced with more uniform slopes that enhance revegetation success and reduce erosion potential. Following soil replacement and revegetation, microorganism populations should naturally recolonize within a few years.

Within the life-of-mine area, and the area to be reclaimed at the Huntley loadout, revegetation success would be enhanced by mulching, fertilization, pest control, access control, seedbed preparation, and appropriate soil replacement technique. Multiple vegetation communities are planned for revegetation. Erosion control measures, and reseeding plans would be implemented if necessary. Unsuitable material from the spoil would be segregated by special handling during placement in the WDA (see Backfilling (Special Handling), Appendix A).

Along the rail spur right-of-way, topsoil would be re-spread and an improved pasture vegetation seed mix would be used between the fire control barrier and right-of-way edge immediately following construction. The compacted subsoils and abrupt slope of this area would limit soil productivity and reduce expected revegetation success. During abandonment the area directly under the track ballast would be reseeded but would not be reclaimed, except on State-owned parcels, and the productivity of this 60 acres would be permanently reduced. Extreme compaction and reduction or loss in nutrient content and biological activity of soils in this area would limit natural revegetation success (see Topsoil Replacement, Appendix A).

The Agency concludes that impacts to soil productivity in areas of mining-related surface disturbance would be moderate to major over the short term and minor over the long term. Productivity losses under the track ballast would be irretrievable.

6. Hydrology

a. Impacts to ground and surface water supplies in and around the life-of-mine area from mining and mining-related subsidence.

Aspects of the mining operations that have the greatest potential to impact ground water supplies in and around the life-of-mine area include mine dewatering and removal of coal hydrologic units (see Figure IV-1). The Mammoth coal and saturated zones immediately above would be impacted during mining from removal and dewatering. The drawdown would extend furthest in the sandstone unit above the Mammoth coal but due to low permeability and relatively low hydraulic gradient, the drawdown would not extend far beyond the life-of-mine area. Five private wells using this aquifer have a high probability of being destroyed or removed by mining and related dewatering. Two private wells may have their productivity decreased by mining and related dewatering. In addition, the mining operation would reduce recharge to the upper underburden, the zone in the first 30 feet below the bottom of the Mammoth coal. The zone has low permeability and the extent of impact should be limited. In 5 years, the extent of a 5-foot drawdown could be less than 2 miles. The mining operation would have minimal impact on the deeper underburden zone. After mining, flooding of lower workings would be allowed and filling of the mine pool would occur. Rate of pool rise should taper off due to seepage, and heads should eventually stabilize at the portal level, about 50 feet below the premining levels, and discharge into PM Draw. The mine pool should stabilize at the portal level as a result of seepage and portal discharge and should act as a permanent sink for area ground water.

Mining-related subsidence has the potential to impact ground water systems in the overburden. Water-bearing units would be affected to varying degrees depending on structural,

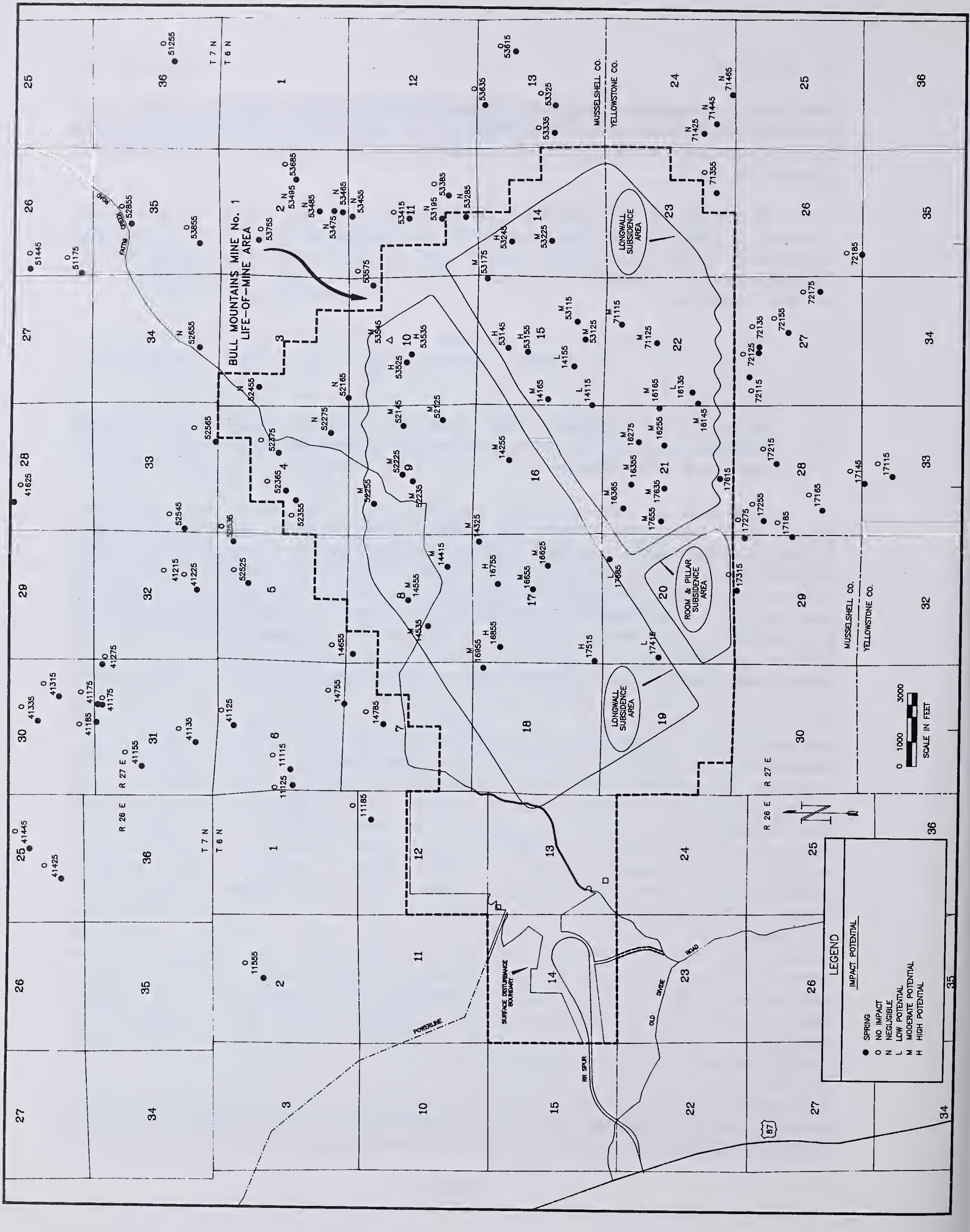

BULL MOUNTAINS MINE No. 1
LIFE-OF-MINE AREA
LONGWALL SUBSIDENCE AREA
ROOM & PILLAR SUBSIDENCE AREA
LONGWALL SUBSIDENCE AREA
SURFACE DISTURBANCE BOUNDARY
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
POWERLINE
RR SPUR
OLD DIVIDE ROAD
87
0 1000 3000
SCALE IN FEET
LEGEND
IMPACT POTENTIAL
● SPRING
O NO IMPACT
N NEGLIGIBLE
L LOW POTENTIAL
M MODERATE POTENTIAL
H HIGH POTENTIAL

Figure IV-1 Potential for impacts to springs

locational, and mining-specific variables. Permeability increases and lowered water tables may be experienced as tensional stresses open cracks and fractures and accentuate the flow of water. Recharge may be increased by tension fractures within clinker and other zones during and immediately after mining. Some changes in recharge and flow characteristics would be permanent. Following the initial deformation of subsidence, ultimate settlement will tend to compress tensile fracture widths to some extent and partial recovery of premining hydrologic conditions can be anticipated (Booth 1986 and 1992; Van Roosendaal et al. 1990; Pendleton 1986).

While a single summarizing impact to the overall hydrologic balance of the life-of-mine area is difficult to predict, it is clear that shallow fractured bedrock and alluvial ground water systems that feed springs and seeps have the potential to be disrupted. The discharge of ground water from these systems to springs and seeps and ultimately through the tributary drainages could be diminished, lost, or relocated over the short and long terms. The possible disruption of flow through the tributary drainages could affect the potential alluvial valley floors (AVFs) in Rehder, Fattig, and Railroad creeks.

Hydrologic mitigation plans are proposed to ensure that quantities of ground and surface water would be replaced, and water rights protected, in and around the life-of-mine area. Water supplies would be replaced for landowners that would lose all or part of their water as a result of mining operations. Mitigation plans are proposed for springs and seeps that provide water for wildlife, livestock, and wetland plant communities and aquatic life. Specific plans propose implementable alternatives for mitigating losses to the springs and seeps having the highest potential for impact. Specific mitigation plans (see Table A-3, Appendix A) have been proposed for 42 springs (including Red Fork, Busse, Dunn Corner, Cold Water, Litsky, and Big). The remaining 88 springs in and around the life-of-mine area are not believed to be at substantial risk but would be monitored and appropriate mitigation implemented if mining-related impacts were detected (see tables III-3 and E-8, Appendix E). Tributary drainages to the potential AVFs and mine pool discharge would be monitored as well. Mitigation plans include phases that: 1) provide an interim water supply to impacted spring sites; 2) attempt to repair and enhance the natural restoration of impacted spring sites; and 3) if necessary, provide a permanent replacement or supplemental water source. Mitigation plans would ensure the maintenance of hydrologic functions for the potentially insignificant

AVFs. Mitigation techniques would include fracture sealing and flow rerouting, using culverts and channel lining, where appropriate.

The potential for the success of hydrologic mitigation could be enhanced by planning flexibility. If natural restoration enhancement or low maintenance techniques were not successful, water would be replaced by wells and distribution systems. There may be short periods between mitigation phases or steps where water may not be available. When mitigation activities were complete, dependable supplies would be available. Mitigation systems could supply flows of water that could be slightly more or less than a particular spring previously discharged. Mitigation systems would have the potential to provide water for longer durations during the year than springs naturally provided. Replacement water supplies may, however, limit the water available to wildlife, change the quality and character of wetlands and limit water availability for future, competing uses. Mitigation systems would remain as long as needed after mine closure with maintenance supported by a financial trust established under the supervision of Montana DSL for permanent maintenance and operation of hydrologic mitigation facilities (see Hydrologic Mitigation, Appendix A).

The Agency concludes that if the mitigation measures are in compliance with MSUMRA and if the mitigation measures are successful, impacts to ground and surface water supplies in and around the life-of-mine area from mining and mining-related subsidence would be minor to moderate over the short and long terms.

However, if the mitigation measures fail (if they are unable to restore the ecological and hydrological functions of the disrupted resources) there would be an irreversible and irretrievable loss of the resource in the area where the mitigation failed.

b. Impacts to water quality in and around the life-of-mine area from mining and mining-related subsidence.

Subsidence from longwall mining would have the potential to impact ground and surface water quality. Within the Bull Mountains area, ground water is of a quality marginally suitable and not recommended for direct human consumption due to high levels of inorganic (mineral) constituents including sulfate. Where surface water is the result of ground water discharging to springs and seeps, it is also not recommended for human drinking water. Subsidence from longwall coal mining would have the potential to increase levels of the same inorganic contaminants that currently limit the suitability of the water for various uses.

As subsidence cracks and deforms rock layers that overlie mine workings, new rock faces are exposed to physical and chemical processes that occur where air and water can penetrate. The rock faces expose new minerals to ground water percolating through the fractures. These minerals can then be dissolved by the water, increasing the water's mineral content. This increase is generally offset by corresponding increases in flow. The same subsidence forces and related fracturing that expose new mineral sources to ground water provide the means for that ground water to move through rock layers more quickly. Since ground water has more and wider fractures through which to move, residence time (the time that ground water remains in contact with a rock layer as it percolates through the layer) is reduced. Residence time is a major factor in determining the amount of minerals that can be dissolved by the water. If ground water percolates more quickly, residence time decreases, and the ability of ground water to dissolve minerals may decrease.

Subsidence is not predicted to have a very large impact on concentrations of inorganic constituents in ground or surface water. Concentrations of inorganic constituents in postmining ground and surface water should remain at or near premining levels and water would continue to be suitable for wildlife, agricultural, and livestock uses (Thompson 1982; Reiten and Wheaton 1989).

The Agency concludes that impacts to water quality from mining and mining related-subsidence would be negligible to minor over the short and long terms.

c. Impacts to ground water quality and quantity in and around the life-of-mine area from mining and mining-related operation of wells.

Wells for potable water supplies, mining operations, and hydrologic mitigation plan requirements would be operated in the life-of-mine area.

Four existing wells, less than 200 feet deep in the Fort Union formation, would supply the potable water system within the surface facility complex. The wells would pump water to a treatment system and storage tank (see Ancillary Facilities, Appendix A). The predicted effect of operating potable supply system wells would be limited to minimal drawdown during operation. Test-pumping one of the wells at 5 gallons per minute (gpm) for 4 days resulted in no measurable change in other near by wells. The wells would be plugged and sealed during reclamation.

Two wells (1 operational, 1 standby) would be designed to pump about 500 gpm from a depth of 8,000 feet in the Madison formation to supply water for coal preparation (see Wells, Appendix A). Estimated drawdown at 10 miles from the site, based on well head calculations, would be about 0.4 percent of the available head (U.S. Geological Survey 1979). Since there are no other wells extracting water from the Madison formation in the vicinity of the mine, impacts on ground water supplies from operating the deep wells would be limited to short-term drawdown or head loss, which should be minimal. The quality of surface and ground water downgradient from the coal preparation operations could be affected by the discharge of the brackish water pumped from the Madison Formation. The 2 wells would be plugged and sealed during reclamation.

Hydrologic mitigation activities (see Hydrologic Mitigation, Appendix A) include 2 shallow wells and 2 deep wells. The 2 shallow wells would be installed to replace disrupted spring flow where horizontal drains may not be effective due to access or topographical barriers or where the adjacent shallow ground water system had been dewatered. The shallow wells would penetrate the shallow fractured and weathered bedrock at 50 to 100 feet and would be pumped by windmills. The shallow wells would pump small quantities of ground water at variable rates to permanent storage and delivery systems. The wells would remain after mine closure. Maintenance would be supported by a permanent trust fund. The limited withdrawals should have no predictable effect on ground water supplies in the shallow aquifer system.

The 2 deep wells would be installed in those areas where subsidence-related fracturing is predicted to completely dewater the shallow ground water system. The deep wells are planned to penetrate deep underburden sandstone below the Mammoth coal seam. The 600- to 700-foot deep wells would be equipped with electric pumps for discharging water to permanent storage and delivery systems. Sustained yields between 10 and 14 gpm could be expected. Drawdowns, 2 miles from the well, are predicted to be between 13 and 50 feet which accounts for between 6 and 23 percent of the available 220-foot head. With no other known wells completed in the same formation, there is no potential for the deep hydrologic replacement wells to affect supplies for other uses. The wells would remain after the mine closed with maintenance supported by a permanent trust fund (see Postmining Topography, Appendix A). The effect of operating the deep replacement wells would be limited to the lowering of head.

The Agency concludes that impacts to ground water quality and quantity in the life-of-mine area from mining and mining-related operation of wells would be minor over the short term and negligible over the long term.

d. Impacts to ground and surface water quality in sections 12 and 13 from mine waste disposal.

Mine waste would be disposed of in the WDA. About 19,000,000 tons of waste would be spread over an underdrain of non-slaking rock with side drains that directed flows to the underdrain for discharge. The drain system would control the discharge of and to ground water in the vicinity of the WDA. Waste material would be spread on the WDA in maximum 2-foot lifts and compacted to 90 percent dry density. Coal processing waste would be air-dried prior to compaction. Topsoil would be respread and the surface revegetated when final elevations had been reached. Diversion channels and sedimentation ponds would contain runoff from the WDA while under construction and until permanent vegetation had been re-established. Diversion channels in the WDA and sedimentation pond WDA would be designed to accommodate a 100-year/24-hour runoff event. There should be little or no potential for discharge of soluble or suspended waste constituents during construction or after completion of the WDA. However, if water that has percolated through the waste and accumulated soluble constituents were discharged to downgradient surface water and ground water, downgradient water quality would be impacted.

The Agency concludes that impacts to ground and surface water quality in sections 12 and 13 from mine waste disposal would be negligible to minor over the short and long terms.

e. Impacts to ground water quality in the Huntley area from loadout operation.

Dust control, runoff from stockpiled coal, and operations at Huntley loadout would produce runoff water with high amounts of suspended and dissolved solids. Runoff from operations and rainfall is currently directed to a lined sediment pond on the loadout site (see Appendix B). Directing runoff to the lined pond would continue to prevent large quantities of water from standing on the soil surface, infiltrating into the soil, and percolating toward ground water during proposed operations. Small quantities of runoff and precipitation would evaporate from the soils in the area. Coal waste and other materials are not expected to contaminate ground water in the loadout area. They would be collected in the pond and removed to the WDA during reclamation or as needed.

The Agency concludes that impacts to ground water quality in the Huntley area from the loadout operation would be negligible over the short and long terms.

f. Impacts to alluvial ground water supplies in the Huntley area from the water supply well at the loadout.

The water supply well at the Huntley loadout site was installed by Meridian in 1990 to supply water for dust control and operations purposes. The 20-foot well is installed in alluvial gravel that is characterized by sand and gravel mixed with very large cobbles. Assuming permeabilities in the mid-range characteristic of such aquifer materials (Freeze and Cherry 1949), the proposed pumping rate of about 20 gpm would create minimal drawdown as close as 1,000 feet from the well. The well is proposed to remain operational after Meridian's use of the loadout. Future operations should not extend drawdown effects beyond those predicted for Meridian's use.

The Agency concludes that impacts to alluvial ground water supplies in the Huntley area from the water supply well at the loadout would be negligible over the short and long terms.

7. Vegetation

a. Impacts to wetland communities in and around the life-of-mine area from mining-related subsidence.

Up to 9 acres of wetland communities could be disrupted by subsidence, reducing or eliminating critical ground water recharge to some of the springs and seeps in the area (Meridian Minerals Company 1989-1992). Not all sites making up the 9 acres would be completely disrupted. Impacts could range from short, intermittent, and temporary disruptions to total and permanent disruption, depending on the extent of subsidence at each location. Of the 5 springs having a high importance to vegetative communities, 3 are predicted to undergo a major impact from subsidence and 2 are predicted to sustain subsidence-induced impacts that have the potential to become major. Of the 4 springs with moderate importance to vegetative communities, 1 has been predicted to undergo a major impact from subsidence and 1 has been predicted to sustain an impact that has the potential to become major (see Table E-8, Appendix E).

Some wetland communities may be temporarily disrupted, with effects being similar to naturally-occurring drought or intermittent rather than continuous flow.

Upon complete loss of water at some affected sites, competitive relationships among plants could cause changes in community composition, with "dry-land" species replacing wetland species. Aggressive species, especially weeds, could initially flourish in those limited areas where moisture conditions and soil stability were extensively disturbed by subsidence.

Wetland communities permanently disrupted by subsidence would be replaced with alternative, consistent water sources, concurrent with planting of native wetland species (see Revegetation Operations, Appendix A). Natural revegetation would also begin immediately, principally from wind dispersion of the reproductive mechanisms of native wetland species. In some cases, an impacted wetland site that contains a depression might trap adequate precipitation moisture to maintain some of the previously existing wetland species.

Replaced wetland communities should be able to provide habitat diversity and function very similarly to original wetland communities within 2 to 5 years.

The cumulative 9 acres of disturbed wetlands represent a very small proportion of the life-of-mine area, less than 0.1 percent, but comprise a moderate proportion of existing life-of-mine area wetland communities (Meridian Minerals Company 1989-1992). However, existing sites would be affected gradually, over mine life, thus the impact at any given time should be minimal.

The Agency concludes that if proposed mitigations are consistent with the provisions of MSUMRA and if the proposed mitigations were successful, impacts to wetland communities in and around the life-of-mine area from mining-related subsidence would be moderate over the short term and minor over the long term.

However, if mitigations failed, there would be an irreversible and irretrievable loss of the wetland community resource in that area.

b. Impacts to wetland communities along the rail spur from construction, operation, and reclamation activities.

Direct excavation and filling, eliminating most or all of the vegetation and disrupting the soil, would temporarily disrupt up to 1 acre of wetland community during rail spur construction (ECON INC. 1992b). The wetland acreage impacted would be a very small proportion of the land area bisected by the proposed rail spur.

To mitigate the 1-acre wetland disruption, depressions along the right-of-way borrow area would be created, forming more than 1 acre of new wetlands (see Revegetation Operations, Appendix A). Although right-of-way postconstruction seeding would not include wetland species, those species should establish in newly wet areas rather quickly (carried by the wind and in bird and animal droppings). The new wetland communities should be similar in composition and function to the disrupted community within 2 to 5 years.

The Agency concludes that impacts to wetland communities along the rail spur from construction, operation, and reclamation activities would be minor over the short term and negligible over the long term.

c. Impacts to vegetative productivity and community stability along the powerline easement and the rail spur from mining-related disturbance.

Disturbance along the powerline easement would have a small, temporary impact on vegetation productivity and stability. During construction, surface disturbance would cause temporary localized plant community instability, characterized by invasion of weedy plants. Where noxious weeds (spotted knapweed and Canada thistle) invaded, control measures would be used. The rhizomatous native grass species dominating the plant communities of the easement are resistant to disturbance and are strong soil stabilizers (ECON INC. 1991a).

Plant community disturbance within the rail spur right-of-way would be extensive during construction, particularly in cut-and-fill sections. The low productive potential of some soils would limit reclamation success on the western portion of the right-of-way.

Graded slopes between the fire control barrier and the edge of the right-of-way would be seeded immediately after rail spur construction. At the conclusion of rail use, the rails, ties and ballast would be salvaged and the base grade of the rail spur would be seeded with the improved pasture vegetation type seed mix and abandoned in place, except on State-owned parcels (see Revegetation Operations and Table A-2, Appendix A). The proposed treatments should provide long-term stabilization and productivity outside the fire barriers.

The top of the abandoned roadbed may support a desirable plant community with stable but lower productivity in 10 to 15 years after abandonment. Introduced crested wheatgrass used to seed the roadbed should have no effect on the species composition of adjacent vegetation communities.

The Agency concludes that impacts to vegetative productivity and community stability along the powerline easement and rail spur from mining-related disturbance would be moderate to major over the short term, depending upon the success of the revegetation and the intensity of the uncontrolled weed invasion, and negligible over the long term. The loss of vegetation productivity until re-establishment by successful reclamation would be irretrievable.

d. Impacts to vegetative productivity and community stability within the surface facility complex and the Huntley loadout from mining-related disturbance.

Proposed mining-related activities would result in up to 871 acres being disturbed, of which 101 are already disturbed by the PM Mine. The disturbance would cause impacts to vegetation productivity and community stability within the surface facility complex. Impacts would occur from displacement of soils and vegetation during construction and operation activities. Weedy plants would accompany disturbance and could include noxious species, such as spotted knapweed, that could persist throughout mine life.

Proposed reclamation would return a number of grass-dominated plant communities to the area (see Revegetation Operations, Appendix A). Productivity and stability would be restored within 2 to 5 years to equal or exceed that of premining communities, although plant diversity could be reduced from premining levels.

Small stands of ponderosa pine community would be destroyed in the 170 acres making up the WDA portion of the surface facility complex. However, the ponderosa pine community is the most extensive vegetation community in the area and the affected acreage would constitute a small percentage of the type. The impact would be mitigated over time by reclamation planting of juvenile ponderosa pine (see Revegetation Operations, Appendix A).

The Huntley coal loadout would be cleaned up at the conclusion of coal-loading use. The sediment pond would be allowed to evaporate, and the sediment and liner along with any remaining coal waste would be removed to the WDA and buried. The pond site would be backfilled with the original soil and seeded (see Topsoil Replacement and Revegetation Operations, Appendix A). Vegetation establishment on the former pond site should be accomplished in 2 years if the site was not disturbed for some new commercial use.

The Agencies conclude that impacts to vegetative productivity and community stability within the surface facility complex and Huntley loadout from mining-related disturbance would be moderate in the short term and negligible in the long term. The loss of vegetation productivity until successful re-establishment by reclamation would be irretrievable.

8. Wildlife

a. Impacts to tree- and cavity-nesting birds in and around the life-of-mine area from mining-related subsidence.

Most obligate cavity-nesting birds found in the area are small (e.g., woodpeckers, swallows, bluebirds, wrens) and make use of a variety of cavities in trees, rock cliffs, and earth banks. The 1984, wildfire swept through much of the Bull Mountains, creating an abundance of snags and potential cavities for small-bird nesting. Larger species such as prairie falcons, turkey vultures, and great horned owls have fewer options and for the most part are restricted to cavities found in rock outcrops. Other raptors nest in trees, large shrubs and on hill sides, all of which are plentiful in the area.

Subsidence could cause some trees and snags to fall, earth banks to fail, and rock cliffs to collapse. Home ranges of large cavity-nesting birds are large enough to allow them to take advantage of the abundant rock outcrop habitat available elsewhere. Subsidence would be more likely to create than destroy rock outcrop cavities. As reclamation progressed, rock piles as large as 1,000 square feet would be established at a density of about 10 to 15 piles per 640 acres (see Wildlife Habitat, Appendix A).

The Agency concludes that impacts to tree- and cavity-nesting birds in and around the life-of-mine area from mining-related subsidence would be minor over the short term and negligible over the long term.

b. Impacts to sharp-tailed grouse nesting and brood-rearing habitat, turkey-roosting habitat, and mule deer winter range from construction, operation and reclamation of the waste disposal area (WDA).

The WDA would fill a drainage that has timbered slopes and grassland valley floor representing a small proportion of the ponderosa pine-mixed grassland community in the life-of-mine area (Meridian Minerals Company 1989-1992). The WDA would be unavailable to most wildlife species during construction and use. As mature ponderosa pine were gradually removed from WDA slopes, turkey-roosting habitat would be reduced. As the drainage was filled, activity could temporarily displace turkey use of the WDA. Nesting and brood-rearing habitat for sharp-tailed grouse would be temporarily displaced to adjacent undisturbed ponderosa pine-mixed grassland habitat during construction. Construction and operation of the WDA would temporarily reduce deer utilization, especially during winter.

Similar topography and vegetation is available in adjacent drainages, well within the radius of daily sharp-tailed grouse, wild turkey, and mule deer activity. Reclamation plans call for restoring similar vegetation components and functions, but with some area and distribution differences. For example, final reclamation would restore some but not all of the timbered slopes present before construction of the WDA. Initial reclamation would include planting of trees and grassland with the shrub component left to natural invasion (see Revegetation Operations, Appendix A). As reclamation progressed, sharp-tailed grouse, turkeys and deer would likely be attracted to the area as a forb component became an important ingredient of early reclamation efforts. Initial plant communities with stands of forbs and grasses could enhance both nesting and brood rearing for sharp-tailed grouse, and food for turkeys and deer, and at maturation be as functional for those purposes as the original habitat.

The Agency concludes that impacts to sharp-tailed grouse nesting and brood-rearing habitat, turkey-roosting habitat, and mule deer winter range from construction, operation, and reclamation of the WDA would be minor over the short term and negligible over the long term.

c. Impacts to elk, deer, and antelope in the Bull Mountains area from increased human activity and development associated with mining-related activity.

Elk are not numerous in the Bull Mountains (92-100) and are probably maintained at a tolerance level established by landowners (Dusek 1978; Meridian Minerals Company 1989-1992). As human activities (e.g., mining, subdivision) increased, elk would redistribute their activities for avoidance when possible. Spreading subdivision, and adding more people, dogs, and livestock to adjacent elk habitat may have a greater impact on elk distribution than mining. When human activities increased to the point where adequate isolation for elk would be unavailable, elk numbers should decrease.

Mule deer appear more tolerant of human activity than elk, may compete less directly with domestic livestock, and are more numerous than elk in the Bull Mountains. Deer are observed commonly near ranches and in the vicinity of the current mining activity at the PM Mine. Antelope in the area are seasonal, moving out of the Bull Mountains onto Commanche and Hay basins during the winter. Much of the summer use by antelope is associated with agriculture. Antelope are apt to be influenced favorably by initial rail spur-reclamation planting communities.

Poaching levels in the Bull Mountains area are now considered "very low" but would be expected to increase somewhat with more human contact associated with Project development (Roger Fliger, Montana Department of Fish, Wildlife and Parks, personal communication, March 9, 1992).

The Agency concludes that impacts to elk, deer, and antelope in the Bull Mountains area from increased human activity and development associated with mining-related activity would be minor over the short term and negligible over the long term.

d. Impacts to wildlife productivity within the life-of-mine area from mining-related subsidence.

Gradual subsidence-caused changes that could temporarily influence the seasonal distribution of elk, deer, and other wildlife include topography, vegetation, and water availability. Water resources at 42 of the 130 existing springs and seeps in the Bull Mountains area could be disrupted by mining-related subsidence (see Hydrologic Mitigation and Table A-3, Appendix A). Of the 8 springs having a high importance to wildlife, 3 are predicted to undergo a major impact from subsidence and 3 are predicted to sustain subsidence-induced impacts that have the potential to become major. Of the 16 springs with moderate importance to vegetative communities, none have been predicted to undergo a major impact from subsidence and 6 have been predicted to sustain an impact that has the potential to become major (see Table E-8, Appendix E).

It is unlikely that subsidence would be perfectly uniform. Resultant topographic and vegetation changes could provide somewhat greater habitat diversity than currently exists. Changes in ground configuration could cause exposure of mineral soil, which could result in greater vegetative diversity. Animal den sites could be disturbed and created. Most wildlife species are accustomed to irregular ground surface, so "accidents" as a result of subsidence are not likely.

Water resources disrupted by subsidence would be replaced by various methods such as optimizing water retention, pond development, spring renovation, water distribution system development, repair of shallow fractures, horizontal drains, vertical wells, and guzzlers. In the interim between disruption and mitigation, rapid response methods to assure a continuous water supply would include hauling water to temporary or existing stock tanks (see Interim Water Supply, Appendix A). Wetland enhancement of 9 acres outside the life-of-mine area would provide additional mitigation for wetlands being temporarily or permanently disrupted. The provision of assured permanent water sources by reclamation would allow wildlife distribution to easily approximate present conditions.

Shallow fractured bedrock and alluvial ground water systems that feed springs and seeps have the potential to be disrupted by several aspects of mine construction and operation. The discharge of ground water from these systems to springs and seeps would be diminished, lost, or relocated over the short and long terms. Disruption of water supply may affect up to 15 acres of wetlands to varying degrees. Impacts may range from temporary disruption with effects being similar to naturally-occurring drought or intermittent water supply, to complete loss of water, (and aquatic habitat) at some affected sites. Aquatic animal communities would be correspondingly affected. Complete loss of water to an aquatic habitat would result in the loss of the associated animal community. Impacts could range from short, intermittent, and temporary disruptions to total and permanent disruption, depending on the extent of subsidence expression at each location. Potential effects include shifts in invertebrate community structure, with species tolerant of disturbed situations becoming more competitive; loss of some less tolerant species; and concentration of aquatic animals, increasing competition for food in an already stressed aquatic system. Larger, more mobile aquatic species may be displaced to surrounding unaffected habitats, depending on their availability. Of the 4 springs having a high importance to aquatic animal communities, 2 are predicted to undergo a major impact from subsidence and 2 are predicted to sustain subsidence-induced impacts that have the potential to become major. Of the 7 springs with moderate importance to vegetative communities, 2 have been predicted to undergo a major impact from subsidence and 2 have been predicted to sustain an impact that has the potential to become major (see Table E-8, Appendix E).

Specific mitigation plans (see Table A-3, Appendix A) have been proposed for 42 springs. The remaining 88 springs are not believed to be at substantial risk but would be monitored and appropriate mitigation applied if mining-related impacts were detected (see Table E-8, Appendix E). Aquatic animals would be expected to colonize mitigation sites and replaced wetland communities should be able to provide values and functions similar to original wetland communities within 5 years.

The Agency concludes that impacts to wildlife productivity within the life-of-mine area from mining-related subsidence would be minor over the short term and negligible over the long term.

For aquatic animals, if proposed mitigations are consistent with the provisions of MSUMRA and if the proposed mitigations were successful, impacts to aquatic animals in the life-of-mine area from mining and mining-related subsidence would be minor to moderate over the short term and negligible over the long term.

However, if mitigations failed, there would be an irreversible and irretrievable loss of the aquatic animal resource in that area.

9. Transportation

a. Impacts to traffic flow and public safety along public highways from mining-related traffic.

There would be more traffic on public highways in Musselshell and Yellowstone counties when the proposed coal mine began operation. Mine workers would drive from home to work, trucks would haul coal from the mine to the loadout at Huntley, and service-related vehicles would travel to the mine to deliver supplies and perform construction and maintenance operations at the mine.

The impact of mine worker and service-related traffic would last throughout the time of coal removal. Mine worker traffic would be added to U.S. Highway 87, Old Divide Road, and Fattig Creek Road. On an average day, 400 vehicle-trips could be added to these roadways. These trips would occur throughout the day with peak traffic at times when work-shift changes occurred. It is anticipated that there would be a small number of mine service-related vehicle trips during daytime hours.

Trucks hauling coal from the mine and returning to reload would add to the number of trucks traveling on roadways in the area during the 2- to 3-year operation of the Huntley loadout. Trucks would operate 24 hours a day at a rate of 4 trucks per hour (see Coal Transportation, Appendix A). This would add 192 truck trips to the truck haul route. After construction of the proposed rail spur, coal hauling to the Huntley loadout would be discontinued.

The overall impact of mine-related traffic would be to add more vehicles to the area roadways, thereby lowering the Levels-of-Service (LOS) and potentially increasing the number of accidents. Increased exposure between mine-related traffic and school buses could increase the chance of an accident (Donald Cromer, pers. comm., May 4, 1989). All of the proposed coal trucks and mine-related traffic traveling to and from the Billings area would cross the pedestrian school crossing north of the U.S. Highway 87/Highway 312 intersection.

Coal trucks traveling at normal highway speeds could have some flying rock/coal coming from their loads. The loose material could distract a following or passing driver and cause loss of vehicle control. Excessive dust could obscure visibility. Covered loads, washed coal, and air foil windscreens proposed for the trucks would lessen the chance of flying rock/coal from the trucks.

Since there are no traffic signals at either the north or south Old Divide Road/U.S. Highway 87 intersections, all turning traffic from Old Divide Road onto U.S. Highway 87, and left-turning traffic from U.S. Highway 87 onto Old Divide Road must yield to through traffic on U.S. Highway 87. Mine-worker and service-related traffic could reduce the LOS of the 2 intersections since there would be more vehicles using the intersection and vehicles would wait longer to make turns onto or from U.S. Highway 87. A small number of worker and service-related vehicles could come from the north on Fattig Creek Road.

Coal trucks move slower and require more space and time to make a turn at intersections. They also need more time to accelerate to a normal travel speed from a stopped position. Since southbound trucks would leave Old Divide Road at the south intersection with U.S. Highway 87, they would be assisted in reaching normal travel speed by a slight downgrade. Coal trucks could lower the LOS of the Old Divide Road/U.S. Highway 87 intersection because vehicles would have to wait longer to make turns onto U.S. Highway 87 (Donald Dusek, pers. comm., May 31, 1991).

At the Old Divide Road/ U.S. Highway 87 intersection, several factors could contribute to the accident rate: drivers waiting to make turns from Old Divide Road onto U.S. Highway 87 could become impatient and turn onto the highway in front of traffic on the road; because of a roadway curve and grade on U.S. Highway 87, drivers could misjudge the space and time needed to turn onto U.S. Highway 87; and drivers on U.S. Highway 87 might have to slow down for the mine-related turning traffic (Donald Dusek, pers. comm., May 31, 1991).

Since coal trucks would slow to go up long, steep grades, and since passing zones are not available, the trucks would slow vehicles behind them. The reduction of speed, bunching of traffic into platoons, and inability to maneuver freely could lower the LOS on U.S. Highway 87. Two segments of U.S. Highway 87 could suffer a decrease in LOS from "B" to "C" due to roadway conditions and vertical grades. One segment starts at the Musselshell-Yellowstone county line and extends 2 miles south. The second segment begins 1 mile south of Old Divide Road intersection and extends 4.5 miles south. Overall, acceptable and stable traffic flow would continue to occur along U.S. Highway 87 with coal trucks causing occasional traffic speed reductions.

A greater percentage of trucks on the highway and trucks moving slower than other vehicles increases the chance of an accident (Donald Cromer, pers. comm., March 21, 1989). Two other factors that could contribute to increased truck accidents are trucks' requirements for greater stopping distances, and hills that limit the sight distance for truck drivers. These factors become more important at night and during the winter months.

Reconstruction projects on U.S. Highway 87 would result in a better roadway surface, add stronger and better shoulders, and increase the traffic capacity and safety of the roadway. The increased traffic from mine workers, coal trucks and service-related vehicles would add congestion to the highway during the reconstruction projects. Vehicle stops, delays, and accidents while travelling through a highway work zone would be more frequent with the addition of more traffic. Coal trucks delayed at construction sites could then bunch together rather than being spaced at 15 minute intervals.

Most of the mine-worker and service-related traffic from the Billings area would travel through the U.S. Highway 87/Highway 312 intersection. This additional traffic would increase the vehicle delay and add to congestion at the intersection. The increase in vehicle delay and congestion should not reduce the LOS of this intersection.

Coal trucks traveling from the mine to Huntley could have a difficult time turning at the U.S. Highway 87/Highway 312 intersection (Donald Dusek, pers. comm., May 31, 1991). The left turn from southbound to eastbound toward Huntley is greater than 90 degrees and must be made after a stop. Before turning, the coal trucks would need to wait for a gap in the through traffic on Highway 312. If the wait for a gap was long, trucks could begin the turn without enough time and space, impeding the eastbound and westbound through traffic. This slow maneuver by a fully-loaded truck could reduce the capacity and LOS of the intersection.

Coal trucks returning to the mine from Huntley would have a difficult right-turn maneuver from westbound to northbound at the U.S. Highway 87/Highway 312 intersection (Donald Dusek, pers. comm., May 31, 1991). The path of the truck wheels might not stay within the width of the roadway and the truck tires could ride up onto the curb or track off the pavement onto the roadside. Trucks would make the turn at slower-than-normal speeds and could delay other traffic, thereby lowering the intersection's LOS.

Even though mine-worker and service-related trips would increase traffic on Highway 312, stable and acceptable traffic flow should be maintained. However, coal trucks would travel slower along Highway 312, especially near the U.S. Highway 87 intersection, and since there are no passing zones, the trucks could slow vehicles behind them, bunching traffic into platoons and restricting maneuverability on Highway 312. This increased vehicle delay and restriction of maneuverability should not qualitatively reduce the LOS of this intersection.

On Highway 312, accidents involving coal trucks could occur at a rate greater than for other vehicles, especially during the winter months (Donald Cromer, pers. comm., March 21, 1989). This is because coal trucks may travel more slowly and require a greater distance to stop than other vehicles, take longer to turn, and to accelerate to normal travel speed.

The interaction of coal trucks and seasonal sugar beet and grain truck traffic in Huntley would be of short duration and would occur on roads with light traffic volumes.

The LOS of the Highway 312/Heath Street intersection and at the entrance to the loadout facility could be reduced because of the increased number of vehicles. The potential for accidents would increase with additional trucks approaching the intersections at the same time.

There are few residences on Heath Street in Huntley. Vehicle trips generated from these residences should create few conflicts between the proposed coal trucks going in and out of the loadout. With good sight distance in all directions, and coal trucks restricted to 15 MPH, accidents involving the coal trucks and cars traveling in the Heath Street area should be avoidable.

Because the rate of accidents rises with increases in traffic (American Association of State Highway and Transportation Officials 1990), more accidents would occur at all the intersections and on all roadways from the Project . Accidents should continue to occur at about the existing rate per million vehicle-miles.

The Agency concludes that the impact to traffic flow and public safety along public highways from mining-related traffic would be moderate with the potential to become significant during the 2 to 3 years the Huntley loadout is in operation. Impacts should be negligible over the long term.

b. Impacts to traffic flow and public safety on public and private roads between U.S. Highway 87 and Montana Route 3 from coal train traffic crossing roads.

Coal trains would delay traffic no longer than 10 minutes at the at-grade railroad crossings between the proposed mine and railroad siding south of Broadview (see The Bull Mountains Rail Spur, Appendix A). More vehicles would be stopped on those roadways with higher daily traffic volumes. Trains crossing County and State (Montana Route 3) highways would stop and delay the highest number of vehicles during peak periods of traffic.

When the trains crossed, vehicles would form a line. Traffic would resume after trains passed. The line of vehicles would temporarily lower the LOS, but would quickly disperse because daily traffic volumes are not high and the geometry of the roads is adequate.

The railroad crossing of Montana Route 3 would be located within a 6.5 mile area scheduled for reconstruction in 1995 (see Appendix B). The vehicle delays for construction could be increased because of the railroad crossing. The presence of the railroad crossing could lengthen the reconstruction schedule and increase construction costs.

Coal trains crossing County roads would create the potential for accidents. If sight distance was inadequate as drivers approached an at-grade crossing, there could be vehicle/train or vehicle/vehicle collisions. Sight distance would more likely be limited in areas where crossings occur in hilly terrain or where roadways are curved.

Exposure between traffic and coal trains would be small because trains would run infrequently and traffic would be low. Even with good sight distance, accidents could occur because of poor driver judgement and/or inattentive driving.

The Agency concludes that the impacts to traffic flow and public safety on public and private roads between U.S. Highway 87 and Montana Route 3 from coal train traffic crossing roads would be minor over the short term and negligible over the long term.

c. Impacts to the integrity/stability of County and State roads from trucking coal from the mine to the Huntley loadout.

The required thickness of roadway pavement is determined by the amount of traffic and number of heavy vehicles on the road. Roadway pavement has a limited life before it requires repaving or reconstruction.

Repeated trips of heavy vehicles on a roadway impact both the pavement surface and the pavement structure below the surface (Yoder 1975). Surface impacts include potholes, small pavement cracks and general wear and tear of the surface. Impacts to pavement structure result in large areas of pavement cracking, breakup of the pavement, dips in the road, or ruts in the wheel paths.

Before the rail spur is complete, coal trucks would haul 37.8 ton loads to Huntley (see Coal Transportation, Appendix A). These trucks could accelerate the rate of damage to pavement surface and shorten the life expectancy of the pavement structure. Pavement degradation would increase the need for and cost of maintenance and necessitate roadway reconstruction sooner than expected (Donald Cromer, pers. comm., November 18, 1991).

Damage to the all-weather gravel surface on that portion of Fattig Creek Road used for mine access would also be accelerated. It could become rutted and develop potholes and dips in the surface, thus necessitating continual maintenance.

The pavement surface and structure of Old Divide Road would deteriorate faster from numerous heavy coal trucks. Resurfacing and reconstruction would be necessary sooner because the lifespan of the pavement would be reduced. Repair work would be necessary during coal hauling.

Coal trucks would accelerate wear and tear on U.S. Highway 87 and Highway 312, increasing the need for resurfacing and reconstruction of some segments (Donald Cromer, pers. comm., November 18, 1991). U.S. Highway 87 would sustain the coal truck traffic better than Highway 312 because recent and proposed reconstruction projects would provide generally stronger pavement. Maintenance projects could be necessary during the hauling period, and road reconstruction could be required on Highway 312 sooner than expected.

Coal trucks would worsen existing pavement damage to Heath Street in Huntley. The pavement surface would break up especially at the intersection with Highway 312. Heath Street could require repaving during the coal hauling period.

The Agency concludes that impacts to the integrity/stability of County and State roads from trucking coal from the mine to the Huntley loadout would be major and significant over the short term and minor to moderate over the long term.

d. Impacts to the integrity/stability of County roads in the life-of-mine area from mining-related subsidence.

Mining activities could cause subsidence of Fattig Creek Road where it crosses the life-of-mine area. Subsidence would cause dips in the roadway and/or a weakened roadway structure. Subsidence would force slower vehicle travel because of uneven roadway surfaces. Heavy vehicles traveling on roadways weakened by subsidence could cause further settlement.

Poor road surface conditions would increase vehicle operating and maintenance costs. Weaker road surfaces and roadbed structure would require gross vehicle weight restrictions on the County roads.

An agreement with Musselshell County requires Meridian to repair any damage to Fattig Creek Road due to subsidence. Meridian would be responsible for temporary or permanent relocation of any sections of the road which could not be maintained in a satisfactory condition.

Subsidence could continue after mining activities stopped. However, without repeated use by heavy vehicles, the chance of roadway damage would be reduced.

The Agency concludes that impacts to the integrity/stability of County roads in the life-of-mine area from mining-related subsidence would be minor over the short term and negligible over the long term.

10. Noise

a. Impacts to the Bull Mountains area from noise generated by mining-related activity.

The subjective effects of noise on humans depends on a combination of physiological and behavioral traits. By nature, subjective effects are difficult to describe because different people react differently to noises. For example, a jet airplane flying overhead may disrupt a conversation between people and cause momentary hearing loss. One person might term this occurrence as extremely annoying, whereas another person may find it only a mild nuisance. Community reaction surveys have found that prolonged L_{dn} noise levels approaching or above 80 dB generally disturb people enough that they take vigorous community action to try to reduce or eliminate the noise source.

During construction, the principal source of noise would be from operation of equipment. It was assumed that construction would occur only during the daytime. Noise levels in the vicinity of equipment would range from 80 to 90 dBA. Noise levels decrease with distance from the source. At 1000 feet from the source, levels would be about 60 dBA while at 4500 feet they would be at an acceptable level of about 51 dBA.

During the anticipated 24-hour a day mine operation, principal noise sources would be preparation plant equipment, ventilation fans, construction equipment, conveyors, dumping of coal into bins, trucks, and rail cars. The L_{dn} noise levels would range from 80 to 85 dBA in the vicinity of the main facilities. The L_{dn} noise levels would decrease and reach acceptable outdoor levels of about 50 to 55 dBA at the nearest residences (about 4500 feet from the proposed mine site).

Occasionally, there would be blasting in the rock quarry. "Blast noise," in contrast to traffic noise, is impulsive, generally lasting less than 1 second, and has a rapid onset that can produce a "startle" effect. The noise level at a given location is a function of the source strength (charge weight), meteorological conditions, (e.g., temperature inversion, wind direction and speed) and distance to the observer. Blasting noise from the proposed quarry would probably be audible at the nearest residences as well as others within 1 to 2 miles.

Heavy equipment used at the mine would be well maintained and fitted with adequate mufflers to minimize noise levels. Also, loud stationary equipment would be partially or completely enclosed.

The Agency concludes that impacts to the Bull Mountains area from noise generated by mining-related activity would be minor over the short term and negligible over the long term.

b. Impacts along the rail spur from railroad construction and train-generated noise.

Railroad construction equipment would temporarily increase noise levels along the proposed rail spur. It was assumed that construction would occur only during daylight hours. Residences within 1000 feet of the right-of-way would be subjected to acceptable outdoor noise levels of 55 to 60 dBA during construction. This impact would be temporary since, at any given location along the right-of-way, construction activities should not last more than 45 days.

During regular operations, L_{dn} values would be about 42 dBA at residences 500 feet from the right-of-way and about 38 dBA at residences 1000 feet from the right-of-way. These L_{dn} values are relatively low because a maximum of only 1 train per day would travel from the mine to Broadview. However, during the few minutes that would be required for the train to pass, noise levels would be 85 to 90 dBA at 500 to 1000 feet from the right-of-way.

In the Broadview area, L_{dn} values would be somewhat greater than those presented above. These higher values would result from the regular train traffic on the Burlington Northern mainline which passes through Broadview.

The Agency concludes impacts along the rail spur from railroad construction and train-generated noise would be minor over the short term and negligible over the long term.

c. Impacts from noise generated by coal trucks traveling from the mine to the Huntley loadout.

Coal truck traffic would increase ambient noise levels along U.S. Highway 87, Highway 312, and Heath Street. An increase of about 4 dBA to a maximum L_{dn} value of about 63 dBA would occur 100 feet from the edge of the roads. An L_{dn} value of 63 dBA has been known to elicit widespread community complaints.

Sometime after 1993, reconstruction of 6.2 miles of U.S. Highway 87 is scheduled several miles south of the south entrance to Old Divide Road. If this reconstruction takes place during the time proposed for hauling coal by truck, cumulative noise levels would be higher than along the rest of the route during the 1-year reconstruction period. After reconstruction is complete, cumulative noise impacts would stop and noise would resume preconstruction levels.

Trucks hauling coal would be well maintained and fitted with adequate mufflers to minimize noise levels. Banning the use of "jake" brakes in Huntley and restricting speed on Heath Street to 15 MPH would also help reduce noise. (see Coal Transportation, Appendix A). Truck hauling would be temporary during a 2- to 3-year period, after which noise levels would return to previous levels.

The Agency concludes impacts from noise generated by coal trucks traveling from the mine to the Huntley loadout would be minor to moderate over the short term, and negligible over the long term.

d. Impacts to the Huntley area from the generation of noise due to the construction and operation of the Huntley loadout.

Huntley loadout would be upgraded over a 2- to 3-month period (see Huntley Truck Haul and Loadout, Appendix A). Noise during this period would be construction equipment. Noise levels would range from 55 to 60 dBA at 1000 feet. Noise would decrease to ambient levels (45 dBA) at 3000 feet.

Noise sources associated with operation of the loadout would include arrival and departure of trucks and trains, operation of conveyor belts, dumping coal into the dump bin, dozing the pile, and loading railroad cars. Noise levels within 100 feet of the facility would range from 80 to 85 dBA. Noise levels at the nearest residence, about 500 feet away, (see Figure A-3), would range from 55 to 60 dBA. Noise generated during operation of the loadout would be noticed by Huntley residents, and occasionally would be above acceptable levels recommended by the EPA.

Noise generated by sugar beet and grain trucks from October through January would be added to noise from coal trucks and the loadout facility. Noise impacts would be greater during this 4-month period than during the rest of the year. Regular train traffic would also increase noise levels as trains passed through Huntley.

In order to minimize night-time noise levels at the coal loadout, the bulldozer and loader would have strobe warning systems replacing standard backup alarms. This modification is subject to regulatory approval by the U.S. Mine Safety and Health Administration. After the 2- to 3-year use of the Huntley loadout, noise would return to previous levels.

The Agency concludes that impacts to the Huntley area from the generation of noise due to the construction and operation of the Huntley loadout would be minor to moderate over the short term, and negligible over the long term.

11. Socioeconomics

a. Impacts to employment, personal income, and population from mining-related activities.

Employment created by construction and operation of the proposed mine would include jobs 1) at the mine site, 2) related to transportation of coal to Huntley (years 1 through 3), 3) at the loadout facility in Huntley (years 1 through 3), and 4) due to transportation of coal by railroad (years 3 through 32). In addition, it is expected that secondary jobs would be created due to the demands for goods and services from employees directly related to mine activities.

Local hire ratios are expected to average 75 percent for mine-related workers and 90 percent for secondary workers. About 90 direct and secondary workers and their families are expected to migrate into the area. Three-fourths (68) of the in-migrating workers are expected to move to Billings, while 12 are expected to move to Roundup and 10 to rural areas of the 2 counties. Population impacts on local communities from the Project would be less than 1 percent in Billings and surrounding rural areas, and less than 2 percent in Roundup.

Construction employment would total about 88 jobs; 38 positions at the mine, 12 at the loadout facility, 26 related to the rail spur, and 12 for powerline construction (see Table I-3). From years 1 through 3, operations employment would involve about 300 jobs at the mine, 12 at the loadout facility, and 50 related to coal transport. Following completion of the rail spur, direct mine-related employment would involve jobs only at the mine site; about 300 jobs through mine life. Secondary employment created by mine-related activities (primarily in the trades and services sectors) is expected to total 133 jobs. Most secondary jobs would be created in the Billings area where a majority of the mine workers are expected to live and purchase goods and services.

The Project may compete with several projects in attempting to hire local employees (see Appendix B). In January of 1992, the Billings labor market area, including Billings, Roundup, Huntley, and Broadview, had about 5,000 active applicants seeking employment (Mike Melbourne, Billings Job Service, personal communication, January 29, 1992). Various components of the proposed Project could be expected to require about 225 mine-related workers, 53 transportation and loadout facility workers, and 120 secondary workers from the local available labor force.

While total employment in Musselshell County would increase by an estimated 300-350 jobs (an impact of 20 percent), the economic base would not expand appreciably since most of the workers are projected to live in Yellowstone County. Total employment in Yellowstone County, which would consist of jobs at the Huntley loadout facility and secondary jobs, would be impacted by less than 0.1 percent.

Total wages and salaries (1990 dollars) due to mine-related activities should amount to about $12.0 million per year during full operations. Almost $10.0 million of this income would be directly related to the Project, while an additional $2.0 million would be attributable to secondary employment. Further income also would be realized through the local purchase of supplies and equipment by the mining company. Meridian expects to expend about $3.4 million per year on local purchases (Bob Ochsner, Meridian Minerals Company, personal communication, February 3, 1992).

Little impact on income in Musselshell County is expected since a majority of workers are projected to reside in or near Billings. Consequently, most of the income is expected to be spent in Yellowstone County. In 1989, total earnings in Yellowstone County surpassed $1.2 billion, therefore the impact on Yellowstone County earnings from mine-related activities should be less than 0.5 percent.

Following the conclusion of mining, the number of jobs lost could eventually total about 433 direct and secondary jobs. Negative impacts to employment and income would occur at about the same rate as when the jobs were created. The population may be impacted less since workers associated with the mine may not leave the area because of local employment opportunities, lack of job availability in other areas, or because of family ties or other personal relations in the immediate area.

The Agencies conclude that impacts on employment, personal income, and population from mining-related activities would be minor and beneficial over the short term and minor and negative over the long term.

b. Impacts to public sector fiscal conditions from mining-related activities.

Direct tax revenues from the proposed mine and related facilities should average about $9.0 million per year (1989 dollars). Musselshell County is expected to receive about $1.2 million per year, increasing total revenues to the County by about 80 percent. Roundup Elementary and High School districts should realize increased general fund revenues of 30 percent, or about $700,000 per year through taxation from mining-related activities. Musselshell County equalization taxes for schools are expected to average $1.7 million per year on the mine and coal production. Roundup would not appreciably benefit from direct taxes on the mine. Yellowstone County and Broadview schools are each expected to receive about $20,000 per year from the Project, primarily from taxable valuation on the loadout in Huntley and the rail spur.

The State of Montana would receive an estimated $2.6 million per year through taxes for statewide school equalization, coal severance tax, Resource Indemnity Trust Tax, and royalties paid for mining coal on State lands. The Federal government is projected to receive about $2.8 million per year through taxes related to the Black Lung Tax, Abandoned Mine Lands Tax, and royalties paid on coal mined on Federal properties.

In addition to taxes paid directly by the coal developer and transportation provider, new governmental revenues also would be realized through taxes on fuels used by trucks hauling coal to Huntley, and from payroll taxes on mining-related workers. Diesel fuel and gross vehicle weight (GVW) taxes should total $378,691 for the 2.5 years of hauling coal to Huntley (Don Cromer, Montana Department of Transportation, personal communication, November 18, 1991). Federal payroll taxes are expected to average $1.8 million per year (15 percent tax rate) and State payroll taxes should total $0.6 million per year (5 percent tax rate). In addition to payroll taxes, State and local governments also would benefit from individual taxes such as fees, fines, property taxes, and gambling revenues.

Costs for providing additional services for the projected in-migrating mine workers should be experienced by all governments in the area. The primary costs to Musselshell County are expected to be increased need for law enforcement, and operation and maintenance costs of Old Divide Road. However, increased tax revenues from the mine eventually should cover all increased Musselshell County costs from mine development and coal hauling. Roundup School districts and the city of Roundup are expected to experience minimal costs from adding services for the few families that are projected to move into the area.

Yellowstone County, the city of Billings, and Billings public schools have the capacity to accommodate the small number of projected in-migrating families, and should experience limited costs. The exception may be the additional costs expected for operation and maintenance of streets in Huntley. Rural school districts in Yellowstone County (Broadview, Shepherd, and Huntley), although presently at capacity and potentially overcrowded due to accreditation standards, also are projected to experience minimal costs related to the in-migrating workers and their families.

The primary increase in State expenditures due to mining-related activities would be the operation, maintenance, and potential reconstruction costs of U.S. Highway 87 and Highway 312 from coal hauling to Huntley. Estimates of increased maintenance and operations costs for the 2 highways are not available; however, assuming average statewide maintenance revenue proportions, about $106,000 from the increased fuel and GVW should be available for maintenance. This would nearly double the present maintenance budget of the 2 highways. Pavement damage to the 2 roadways, due to projected coal hauling from the mine to Huntley, could total between $1.3 million and $2.0 million (Donald Cromer, pers. comm., November 18, 1991).

Following closure of the mine, public sector fiscal conditions of local, State, and Federal governments should be negatively impacted at about the same rate as when the mine opened. Musselshell County and Roundup public schools would lose a valuable source of funding and their budgets would realize sizable declines in revenue. Other local governments should be slightly impacted from closure of the mine.

Cumulative activities should not impact public sector fiscal conditions of any governments in the area. Yellowstone County and associated governments have the infrastructure to accommodate in-migrating workers. Very few of the cumulative developments would use government services in Musselshell County, nor would they use the same roadway system as the proposed Project.

The Agencies conclude that impacts to public sector fiscal conditions from mining-related activities would be minor and beneficial over the short term, and minor and negative over the long term.

c. Impacts to law enforcement agencies from mining-related activities.

Agencies responsible for law enforcement in Roundup, Broadview, Shepherd, Huntley, and Billings areas are currently understaffed. Additional traffic and criminal activity as a result of increased population from the proposed Project would stress law enforcement services in the area. Transport of coal by truck from the proposed mine to the Huntley loadout and the increased number of commuting vehicles on the highway would require additional traffic patrol and enforcement efforts. Due to the anticipated increase in traffic, officers may need to commit more time and resources to patrolling U.S. Highway 87 and Highway 312, requiring a shift in patrol duties from other portions of the County. After the rail spur was constructed, coal truck traffic would cease, thus alleviating a portion of the additional workload of traffic patrol officers.

When the mine closed, a small number of people would be expected to leave the area. If law enforcement agencies hired additional staff to meet the needs of the growing population and retained that level of staffing, it is unlikely that the agencies would be overstaffed.

Cumulative development (see Appendix B) primarily would be concentrated in the immediate Billings area; consequently, Musselshell and Yellowstone County Sheriff's departments should not be impacted by the proposed developments. Billings Police Department, which is currently understaffed, would be impacted by the influx of construction workers in the Billings area.

The Agencies conclude that the impact to law enforcement agencies would be moderate when trucks were hauling coal between the proposed mine and Huntley loadout facility. For the remainder of the short term, the impact would be minor. Impacts to law enforcement agencies from mining-related activities would be negligible over the long term.

d. Impacts to housing in the Roundup and Billings areas from mining-related activities.

Rental housing in the Roundup area is limited; however, there are enough houses for sale to accommodate the small number of projected in-migrants to the area. Additional housing may become available for rent by those who have been unsuccessful in selling their homes.

The in-migration of workers and subsequent housing demand may increase the cost of area housing. With increased demand for housing resulting from the proposed Project, it is likely that sale prices of houses would increase. Increased sale prices would be viewed positively by the seller and negatively by the buyer.

A large number of families moving from the area as a result of mine closure is not anticipated; therefore, it is not expected that the housing market would markedly change over the long term. Since there would no longer be a demand for housing by in-migrating direct and indirect workers, the market price of housing may decline somewhat.

Cumulative development should not impact housing in the Roundup area. Temporary shortages of rental housing in the Billings area may be experienced due to cumulative development. Construction activities may last through the summer, a time when motels experience higher occupancy rates due to tourist travel. It is possible that construction workers occupying motel rooms over the construction phase would displace tourists seeking motel accommodations.

The Agencies conclude that impacts to housing in the Roundup and Billings areas would be minor over the short term and negligible over the long term.

e. Impacts to educational facilities from mining-related activities.

Ninety new families are projected to move to the area as a result of the proposed mine development. School enrollment in the Roundup School District is expected to increase by 8 elementary and 4 high school students, while in the rural school districts of Broadview, Shepherd, and Huntley Project, school enrollment is projected to increase by a total of 4 elementary and 2 high school students. An increase of 38 elementary and 15 high school students is projected for the Billings School District.

The majority of in-migrating workers and their families are expected to reside in the Billings School District, which has the capacity to accommodate the small number of added students. Although few workers are expected to move to Roundup, Broadview, Huntley, or Shepherd, schools within these areas are currently at capacity and any additional students could further stress the facilities.

Accreditation standards, which would require smaller class sizes in kindergarten through second grade, will be implemented in 1992. With or without the Project, these standards may require additional educational facilities if newly-enrolled elementary students are not evenly distributed throughout elementary grades.

Positive impacts may result from approval of the Project. School districts within the coal-impacted area would have the opportunity to apply for grants for school facility expansion through the Local Impact Assistance Program of the Montana Coal Board. Approval of the grants would provide funding for expansion of school facilities.

Due to the small number of families expected to move away from the area after mine closure, negligible impacts on school districts should occur over the long term.

Cumulative development in the Billings area should not impact the school districts. It is expected that few in-migrating construction workers would bring their families with them to live for the short duration of construction activities. In addition, the largest portion of construction activities usually occurs during the warmer months of the year, a time when school usually is not in session.

The Agencies conclude that impacts to educational facilities from mining-related activities would be moderate with the potential to become significant over the short term and negligible over the long term.

f. Impacts to social well-being in the Bull Mountains area from mining-related activities.

The magnitude of potential impacts on social well-being would depend on the ability of community members to adapt to social changes resulting from the proposed Project. Past history in the Roundup and Bull Mountains areas with cyclic resource developments such as coal, oil, forest products, and agriculture has imparted a social history of boom and bust. Due to this pattern of life, many social experiences necessary to deal with new development already exist.

Positive impacts to social well-being would be realized through increased job opportunities and local spending. However, since not all jobs created by the proposed Project would be filled by local residents and only a portion of the income would be spent locally, residents with high expectations that the Project would revitalize the area's depressed economy would experience disappointment if the Project failed to provide a large infusion of wages.

Residents who oppose the Project and associated rail spur would be adversely affected by its approval. These residents may experience feelings of anxiety, stress, and a perceived loss in quality of life. Those residents who established and joined grassroots organizations to oppose the Project probably would feel that their attempts had been futile.

Quality of life of Bull Mountains residents who live close to the proposed mine and associated rail spur would be adversely affected. Some residents moved to the Bull Mountains for solitude and they could be disturbed by the noise of construction and operation of the proposed mine and railroad; increased traffic as a result of hauling coal and commuters working at the proposed mine; increased dust created by mining construction and operation and traffic; and increased danger on the haul route due to the frequency in which coal trucks would be leaving and entering the proposed mine site.

Residents who gained economically as a result of the proposed Project would be the primary group impacted in the long term when mine closure eliminated direct or indirect economic benefits. Other groups should not be impacted by mine closure.

Cumulative development in the Billings area should not impact the social well-being of the Bull Mountain residents.

The Agencies conclude that impacts to social well-being in the Bull Mountains area would be moderate with the potential to become significant over the short term and minor over the long term.

g. Impacts to social well-being in the Huntley area from operation of the loadout facility.

Operation of the proposed loadout facility would create additional dust, noise, and traffic and would increase the risk of traffic-related accidents. Currently, Huntley has a railroad stockpiling facility and experiences relatively large volumes of truck traffic, seasonally, during the sugar beet harvest. Some residents consider sugar beet traffic to be tolerable because it does not affect the community year-round, and labor and income associated with the beet harvest remains local. Year-round heavy traffic from coal hauling is widely perceived to represent a major change in the community with little local benefit. Similarly, little income would be generated for Huntley from the proposed loadout facility because truckers would probably reside elsewhere.

Closure of the Huntley loadout facility would be a positive impact on the social well-being of Huntley residents who opposed the proposed Project.

Cumulative development in the Billings area should not impact the social well-being of Huntley area residents.

The Agencies conclude that impacts to social well-being in the Huntley area would be moderate with the potential to become significant over the short term and moderately positive over the long term.

12. Recreation

a. Impacts to outdoor recreational opportunities in the Bull Mountains area from mining-related activities.

Dispersed activities such as camping, fishing, and hiking would not be impacted by mining-related activities. Hunting however, may be temporarily disrupted due to noise, dust, and human activities associated with construction. Temporary displacement of some large game animals would be expected to occur, particularly near the surface facility complex, and along the rail spur during construction. This impact would be limited to those areas where hunting on private land was previously open to the public. Some displaced big game animals could relocate to State and Federal lands and actually increase hunting opportunities in some instances. In general, the impact to hunting would increase with proximity to active construction areas.

As areas of reclamation occurred, elk and deer would be attracted to them. In similar mining operations in Colorado and Wyoming, specially-designed wildlife fences have been constructed to keep deer off reclaimed areas (Bob Carroll, Ecological Consulting Services, Inc., personal communication, March 13, 1992.) Colstrip mine in southeastern Montana has documented problems with large numbers of mule deer trampling and grazing newly-reclaimed areas. Because hunting is usually restricted around a mine, reclaimed areas generally act as a reserve for animals (Bob Carroll, pers. comm., March 13, 1992). As a result of probable increases in wildlife within restricted areas, peripheral hunting opportunities could increase. In addition, reseeding of the railbed after construction would attract deer and elk.

The Agencies conclude that impacts to outdoor recreational opportunities in the Bull Mountains area from mining-related activities would be minor over the short term and negligible over the long term.

b. Impacts to outdoor recreational opportunities in the Huntley area from mining-related activities.

Recreation opportunities in Huntley would be impacted from coal dust generated at the loadout and carried to town by southeasterly winds. The quality of the recreation experience for those engaging in dispersed recreation activities including walking, jogging, and bicycling would be impacted during these times. The closer to the loadout these activities occurred, the greater the impact would be.

Increased coal truck traffic would impact the safety and general enjoyment of walkers, joggers, and bicyclists who used Heath Street for these activities. Impacts would be greatest in October when the sugar beet harvest peaks. During this time, both coal and beet trucks entering Huntley from the north would be using Heath Street. However, due to the existing traffic load on Heath Street, most Huntley residents do not use it as a recreation route (Jim Pope, pers. comm., January 30, 1992.)

Noise impacts would be greatest within 30 to 40 feet of Heath Street and 1,000 feet of the loadout (see Noise). Beyond that distance, noise generated at the proposed coal loadout would decline to a level compatible with outdoor recreation activities. Huntley Community Park, located about 1,000 feet southwest of the proposed coal loadout is at the outer limits of the acceptable range; recreation activities should not be affected.

The Agency concludes that impacts to outdoor recreational opportunities in the Huntley area from operation of the Huntley loadout would be minor over the short term and negligible over the long term.

13. Land Use

a. Impacts to land use in the life-of-mine area from mining-related activities.

- Cropland/Rangeland

  Construction and mining-related activities (primarily subsidence) could progressively disturb 7,041 surface acres of the life-of-mine area. Native grasses, shrubs, and trees would be planted in disturbed areas to restore rangeland. The 17-acre parcel of cropland in the northwest portion of the life-of-mine area may be temporarily disturbed by surface facility construction activities. Disturbed areas should return to equal or better than premining production capacity.

  Surface disturbances caused by subsidence should be temporary (1 to 2 years); the possible exception would be any edge-of-subsidence areas where steep slopes created or worsened by subsidence could decrease soil stability and increase the chance of erosion.

  The surface of the WDA fill area would remain active for the life-of-mine and therefore, unusable during that time period. After total reclamation, the WDA area should be suitable for use as rangeland.

  Water resources at 42 of the 49 springs in the life-of-mine area could be disrupted by mining-related activities (tables III-3 and E-8, Appendix

E). Impacts to these resources would be mitigated through the use of interim water supplies, repair of shallow surface fractures, horizontal drains, vertical wells, guzzlers, ponds (reservoirs), and/or supplementation using water distribution systems (Table A-3, Appendix A). Of the 4 springs having a high importance to land use, 2 are predicted to undergo a major impact from subsidence and 2 are predicted to sustain subsidence-induced impacts that have the potential to become major. Of the 14 springs with moderate importance to land use, 2 are predicted to undergo a major impact from subsidence and 2 are predicted to sustain an impact that has the potential to become major (see Table E-8, Appendix E).

- Buildings

  Buildings located in areas of subsidence could suffer structural damage. Once subsidence had ended, the surface should have adequate stability for construction or reconstruction of most buildings, except for steep slopes where stability would remain questionable.

  The WDA would not be suitable for building during the life-of-mine because of continual use; however, once mining operations ceased and reclamation of the WDA was completed, it should be suitable for construction of most buildings, except where the face of the fill area was too steep.

- Corrals/Fencing

  Corrals and fences located in areas of subsidence could be damaged to varying degrees, depending on the amount of subsidence. Once subsidence had ended and reclamation was completed, they could be repaired or rebuilt.

  Corrals and fences in areas disturbed by construction activities would be removed and could be rebuilt once reclamation activities were completed.

  Fences or corrals could be built in the WDA once waste disposal use of the area ended and reclamation was completed.

- Roads

  Roads located in areas of subsidence would be damaged to varying degrees, depending on the amount of subsidence.

  Surface disturbance, caused by construction activities or subsidence could require that affected roads be relocated or temporarily closed during the period of disturbance. Fattig Creek Road would remain open, providing access through the life-of-mine area. (Sections may be relocated.) Meridian has an agreement with Musselshell County that Meridian would maintain and/or rebuild roads within the life-of-mine area. Once subsidence had ended and disturbed surface areas were reclaimed, roads would be rebuilt.

- Future Development

  A portion (438 acres) of the Yellowstone Basin Properties, Inc. subdivision is located in the north portion of the life-of-mine area, north and west of Fattig Creek. There is no plan to mine this area, therefore continued residential development and use of the subdivision area would not be affected by subsidence or other mining-related activities.

  Land within longwall subsidence areas should generally be suitable for future construction of dwellings or other types of development once subsidence had ended and reclamation was completed. An exception would be those areas where stability would continue to be questionable because of severe slopes.

  Land within the room-and-pillar area (about 240 ares in the south portion of the life-of-mine area) may experience some long-term settling. Because of this potential settling, stability required for structural construction may be affected, thereby impacting future development of this particular area.

  After total reclamation of the WDA had been completed, the surface should be suitable for development, except for the face of the fill area which would be too steep.

Proposed mitigation measures for the life-of-mine area including topsoil placement or replacement, compaction, hydrologic mitigation, and revegetation are described in Reclamation Plan, Appendix A.

The Agency concludes that impacts to land use other than those associated with springs would be moderate over the short term and minor over the long term.

If the proposed spring mitigations are consistent with the provisions of MSUMRA and if proposed spring mitigations were successful, impacts to land use associated with springs in the life-of-mine areas from mining-related activities would be minor to moderate over the short term and minor over the long term.

However, if spring mitigations failed, there would be an irreversible and irretrievable loss of the land use resource in relation to the springs.

b. Impacts to land use along the rail spur from construction and operation activities.

- Cropland/Rangeland

  Land traversed by the proposed rail spur right-of-way is primarily cropland or rangeland. Parcels would be split by the right-of-way and land within the right-of-way would be taken out of production (about 1,150 acres outside the life-of-mine area). Proposed road crossings and cattle underpasses would decrease the impact of split parcels in most instances and indirect access from parcel to parcel would cause inconvenience.

  There appear to be 3 parcels that would be split. These are located in section 6, T.4 N., R.25 E. (owners: G.L. and O.J. Morton); N½ Section 1, T.5 N., R.26 E. (owner: Majerus Ranch, Inc.); and S½ Section 1, T.5 N., R.26 E. (owners: G.A. and E.L. Carlson).

- Corrals/Fences

  Fencing would be installed along both sides of the rail spur right-of-way and existing fences removed and/or repaired as required to maintain safety anland use functions.

- Roads

  The proposed rail spur would cross numerous local and County roads and 2 highways. Plans for the proposed rail spur show about 22 crossings of local and County roads. Three of the crossings would be above-grade, the remainder would be at-grade crossings. Montana Route 3 would have an at-grade crossing and U.S. Highway 87 would have an above-grade crossing.

  Once mining operations had ceased, the track was removed, and reclamation completed, direct access between split parcels could be re-established.

- Future Development

  On non-State-owned sections, only limited backfilling and regrading of the railbed is planned and revegetation would be limited to reseeding disturbed areas with crested and intermediate wheatgrass. Re-establishment of shrub and tree communities would be left to natural invasion. On State-owned sections, complete reclamation including regrading to approximate original contours and revegetation to restore the areas to their premine function, would be required.

  The rail spur right-of-way would be too narrow to be effectively developed in and of itself. Some of the divided parcels are also so small that they would not be economically developable. These impacts would remain so long as the rail spur right-of-way was a separate, individual parcel of land.

The Agency concludes that the impacts to land use along the rail spur from construction and operation activities would be moderate in the short and long terms. The loss of agricultural productivity as well as other economic development of the 1,150 acres of rail spur right-of-way could be irretrievable.

14. Visual Resources/Aesthetics

a. Impacts to visual resources/aesthetics in the life-of-mine area from mining-related activities.

The only area with a high sensitivity level near the life-of-mine area is the U.S. Highway 87 corridor. The corridor is highly sensitive because of its high traffic volume. All other areas have a low sensitivity level because of the sparsely-developed nature and low user volume.

During construction, diesel emissions and dust from startup and operation of vehicles and other construction activities would create some haze. However, watering surface construction areas to control the dust, topographic features that screen the mine from areas of high sensitivity, and distance (U.S. Highway 87 is over 1 mile away from the life-of-mine area at its closest point) would limit visual impact. The duration of construction impacts would be temporary.

During operation of the mine, diesel emissions from the startup and operation of vehicles would create some haze. Topographic screening and distance to any highly-sensitive areas would limit the visual impact from this source. Particulate emissions generated by screening, crushing, conveyance, and cleaning operations would be controlled by fabric filters, water sprays, partially enclosed conveyors, and tube stackers. Any coal fires would be promptly extinguished.

There would be several mine-related surface facilities and disturbances that would, to some degree, adversely impact the aesthetic quality of the existing landscape. The PM Mine and Meridian coal test pit have already scarred a portion of the life-of-mine area. Located on about 871 acres, surface facilities would include the main facilities buildings, coal processing facilities, and ancillary facilities. These surface facilities would be removed and the area reclaimed after mining operations had ended. Surface disturbances at the mine include topsoil stockpiles, excess spoil pile, sediment ponds, rock quarry, haul roads, WDA, WDA subsoil pile, and subsidence areas. Subsidence would have the potential to disturb about 6,170 acres of the life-of-mine area. The most substantial surface disturbance would be caused by the WDA, which would cover up to 169 acres and reach a maximum height of 130 feet. Reclamation measures have been proposed that would reduce the long-term impacts of mining-related surface facilities and disturbances, but not totally mitigate them. Some would permanently scar the landscape.

The WDA's surface would remain virtually flat and the face of the fill would have an unnatural uniform slope that would strongly contrast in form and line with the adjacent landscape. Proposed regrading techniques may not leave a topographically-natural appearing landscape, and tree and shrub plantings may not insure that natural vegetation patterns would be duplicated (see Figure A-11, Appendix A). In general, revegetation, especially trees, would take a long period of time to achieve a natural appearance that would blend with vegetation in adjacent areas undisturbed by mining-related activities.

Mining-related surface facilities and surface disturbances would be screened from highly sensitive viewpoints by topographic features. They would be partially visible from some existing residences and local roads adjacent to the life-of-mine area.

The Agency concludes that impacts to the visual resources/aesthetics in the Bull Mountains area from mining-related activities would be minor to moderate in the short and long terms. The visual contrast of the WDA would constitute an irretrievable commitment of the visual resources/aesthetics.

b. Impacts to visual resources/aesthetics in the Bull Mountains area from the rail spur.

There are 2 areas with a high sensitivity level in the rail spur viewshed; Montana Route 3 and U.S. Highway 87 corridors. These corridors are highly sensitive because of their high traffic volumes. All other areas have a low sensitivity level because of sparse development and low user volumes.

During construction, diesel emissions and dust from startup and operation of vehicles and other construction activities would create some haze. Additionally, most of the rail spur would be screened from highly-sensitive viewpoints by topographic and vegetative screening. The duration of construction impacts would be temporary.

During operation of the mine, both the rail spur and coal trains would adversely affect the visual resources/aesthetics of the area. The proposed right-of-way would come within 300 to 400 feet of 2 ranch houses, and within one-fourth to one-half mile of several others.

The railbed, extensive cuts-and-fills, County road above-grade crossings, and livestock underpasses would be visible during and after the mine life. All are proposed to remain in-place after the rail spur was abandoned. The proposed revegetation of the rail spur would not match or blend with existing, adjacent vegetation, thereby contrasting in color and texture. Large cuts (some more than 60 feet), with slopes of 2:1 and 3:1, are planned for sections of the eastern one-third of the rail spur. The proposed above-grade crossings would have clearances ranging from 26 to 31 feet high, and would be 140 to 180 feet long. The postmining landscape along the rail spur would be permanently impacted if these features remained in place as proposed. Most of these features would be visible only from viewpoints with low visual sensitivity levels, however, some would be visible from the corridors of U.S. Highway 87 and Montana Route 3 which would have high visual sensitivity levels.

The proposed U.S. Highway 87 above-grade rail crossing would be located in a scenic area of rolling, wooded (pine) hills. The top surface of the bridge would be about 30 feet above U.S. Highway 87. The fill slope for the rail spur east of the highway would exceed 50 feet. The grey concrete of the structure would not blend with or compliment the natural colors of the surrounding area. This would be a massive structure, sharply contrasting with the color, form, line, and texture of the adjacent landscape. The bridge would cross a straight section of highway with long sightlines from both the northbound and southbound lanes. This would make it easily visible from relatively long distances. There are no plans to remove the structure after mine life, therefore the visual resources and aesthetic value of the area would be permanently impacted.

Although only causing temporary impacts, coal trains would be very visible especially in the western two-thirds of the rail spur where the landscape is flat and open. Coal trains sitting on the 6,800-foot siding at the junction of the rail spur and Burlington Northern mainline would be immediately adjacent to Montana Route 3 and very visible, and could possibly be visible from portions of Broadview. Trains presently run through the Broadview area on the Burlington Northern mainline.

The Agency concludes that impacts to the visual resources/aesthetics in the Bull Mountains area from the rail spur would be minor to moderate over short and long terms. The larger cuts-and-fills of the rail spur and the structure over U.S. Highway 87 would constitute irretrievable commitments of visual resources/aesthetics.

c. Impacts to visual resources/aesthetics in Huntley from the Huntley loadout.

Huntley would have a high level of sensitivity because of population density, closeness, and unobstructed views of the proposed loadout facility and operations. Highway 312 would also have a high sensitivity level, although impacts would be lessened by distance (about one-half mile from loadout site) and line-of-sight interference (trees and buildings).

During construction, diesel emissions and dust from the startup and operation of vehicles and other construction activities would create some haze. Watering construction areas to control dust would help reduce the visual impact.

Although located in a rail-oriented industrial area, the proposed facilities and operational activities will lower the scenic quality, increasing the impact created by the existing facilities including the grain elevator, sugar beet stockpile and loading site, and other trains using Montana Rail Link line.

Additional adverse impacts to visual resources and aesthetics would be created by coal trains, haul trucks, and loadout equipment. Each would create dust and particulate emissions as well as adding to the visual clutter. Coal dust emissions were a major complaint of Huntley residents during operation of the loadout related to the Meridian coal test pit. Water spraying and partial enclosure of transfer operations should help reduce coal dust emissions.

The coal stockpile, a dominating feature (which could be 600 feet long, 200 feet wide, and 25 feet high), would greatly impact the aesthetic quality of the area because of its strong contrasts in form, color, and texture to the surrounding landscape. The 8-foot fence proposed to enclose the stockpile would do little to mitigate its visual impact.

The Agency concludes that impacts to visual resources/aesthetics in Huntley from Huntley loadout would be major and significant in the short term, and negligible in the long term.

15. Cultural Resources

a. Impacts to prehistoric and historic resources in the Bull Mountains area from mining-related activities.

Potential adverse effects to prehistoric and historic resources would result from direct land disturbance due to construction and operations including subsidence, visual intrusions to the setting or environmental context of historic structures, and unauthorized artifact collecting and vandalism. Each of these activities would disturb or destroy the physical integrity of prehistoric and historic resources. The loss of physical integrity diminishes research potential which contributes to resource eligibility.

Six NRHP-eligible sites currently identified within the life-of-mine area would be adversely affected by mining and mining-related activities. Four NRHP-eligible lithic scatters may be adversely affected by subsidence, resulting in the mixing of subsurface cultural deposits located at the margins of the subsidence areas. One NRHP-eligible lithic scatter may be adversely affected by construction of the proposed rail spur within the proposed surface facility complex. The potentially NRHP-eligible stone circle site may be adversely affected by construction of hydrological mitigation in the proposed life-of-mine area. About 230 additional NRHP-eligible prehistoric sites may be disturbed during construction and operation of the mine.

Twenty-four NRHP-eligible prehistoric and historic sites located in the proposed rail spur right-of-way, would be adversely affected by railroad construction or operations. Thirteen prehistoric lithic scatters and 11 historic sites (8 homesteads and 3 trash scatters) would be disturbed or destroyed by construction of the proposed rail spur. Two of these homesteads have standing structures. These would also be adversely affected by the presence of the rail spur which would destroy the integrity of site settings. Increased access and traffic to the area by construction workers may also result in unauthorized surface collecting and vandalism of NRHP-eligible sites.

Adverse effects to NRHP-eligible prehistoric and historic sites from mining-related activities would be appropriately mitigated by data recovery techniques. Data recovery may include surface collection, excavation, artifact and feature analysis, architectural documentation, archival research, and construction or operations monitoring. Beneficial impacts may occur from data recovery procedures implemented to mitigate adverse effects to NRHP-eligible sites. Data recovery of NRHP-eligible sites would contribute pertinent information to the regional database.

The Agency concludes that impacts to prehistoric and historic resources in the Bull Mountains area from mining-related activities would be minor and permanent. Loss of NRHP-eligible prehistoric and historic sites would be irretrievable.

b. Impacts to Native American (traditional) resources in the Bull Mountains area from mining-related activities.

Potential adverse effects to Native American resources would result from direct land disturbance due to construction and operations including subsidence, visual and noise intrusions on Native American sensitive sites, reduced access to Native American traditional use areas, and unauthorized artifact collecting and vandalism.

Rock art sites sensitive for Native American groups in the proposed life-of-mine area may be disturbed by subsidence; it may cause scaling and collapse of vertical sandstone outcrops within subsidence areas. Springs may be disturbed or destroyed by construction of wetland enhancement and hydrological mitigation. Other types of sensitive sites may be disturbed directly by construction, or indirectly by visual or noise intrusions from construction and operation of the mine.

Several potentially-sensitive areas within the proposed railroad corridor may be disturbed directly by construction, or indirectly by audio or noise intrusion of rail spur construction and operations.

Impacts to Native American resources may be mitigated by appropriate relocation of human remains according to the Native American Graves Protection and Repatriation Act and the Montana Human Skeletal Remains and Burial Site Protection Act. Reseeding, transplanting, or harvesting sensitive Native American plant resources, or planting vegetation screens to reduce visual and noise intrusions would also provide mitigation. Impacts to some Native American resources, such as sensitive rock art sites, cannot be adequately mitigated, resulting in destruction of the resource.

The Agency concludes that impacts to Native American resources in the Bull Mountains area from mining-related activities would be minor and permanent. Because there may be unmitigated and irretrievable loss of some resource types, the impact to Native American resources would have the potential to become significant.

c. Impacts to undiscovered prehistoric, historic and Native American (traditional) resources in the Bull Mountains area from mining-related activities.

Mining and mining-related activities in the Bull Mountains area would adversely affect undiscovered cultural resources. The majority of undiscovered NRHP-eligible resources that may be impacted would be located along ridgetops near steep slopes and near springs and drainages in subsidence areas. NRHP-eligible rock art sites may be impacted by subsidence; it may cause scaling and collapse of vertical sandstone outcrops within the subsidence areas. Undiscovered Native American resources (e.g., burials, vision quest sites, and rock art) may be directly disturbed or destroyed by subsidence near steep slopes and construction of facilities and the proposed rail spur, or indirectly disturbed by visual or noise intrusions from construction and operations.

The Agency concludes that impacts to undiscovered prehistoric, historic, and Native American resources in the Bull Mountains from mining-related activities would be moderate and permanent. The loss of undiscovered NRHP-eligible prehistoric and historic sites, and sensitive Native American resources would be irretrievable and have the potential to become significant.

B. IMPACTS OF DISAPPROVAL UNDER ALTERNATIVE 2

1. Assumptions for the Disapproval Alternative

The assumptions used by the Agency to perform the impact analysis for the disapproval alternative (Alternative 2) include:

- The Project would be placed on indefinite hold, and the permit application package (PAP) submitted to Montana DSL would be withdrawn.
- The existing Huntley loadout facility would be reclaimed as scheduled in the approved Meridian coal test pit permit, no. 90017R. This would include: removal of the portable loadout facilities, collection of the remaining coal waste for disposal at the Bull Mountains test pit, and

reclamation of the sediment pond after evaporation was complete. (Specific details of the existing Huntley loadout facility are included in Appendix B.)

- Reclamation of Meridian's existing coal test pit would proceed according to the approved plan (MT permit no. 90017R). (Specific details of the existing coal test pit facility are included in Appendix B.)

- The PM Coal Company would continue to operate their existing surface/underground mine in the Bull Mountains area according to the approved permit to mine coal (MT permit no. 79008R1). They would continue to supply truck/package-delivery coal to the local market. (Specific details of the existing PM Mine are included in Appendix B).

- Existing resources in proximity to the Project would not be disrupted by new activity related to coal mining. They would, however, be subject to the continuing human and natural processes, including those uses and management activities currently being applied. To accurately evaluate the impacts of disapproving proposed mining-related activity on these resources, analysis of impacts under this alternative examine, to the extent possible, the effects of current management and natural processes on existing resources through the year 2037, the year assumed for final bond release (1993, plus 44 years).

- The life-of-mine area and associated rail spur would be managed for grazing, agricultural crop production, wildlife habitat, and recreation:

    - Livestock stocking rates and management practices would continue at current, premining levels.

    - Wildlife management and recreation opportunity would correspond to Montana Department of Fish, Wildlife and Parks (DFWP) plans for the area.

    - Cropland would continue to be farmed at current, premining levels.

- The area surrounding the Project would be maintained in its current or proposed use:
    - Coal leasing may continue, but no new mines would be developed.
    - Land currently used for agriculture would remain in that use.
    - Land outside the area of the proposed mine, currently used for residential purposes, would remain in that use. New residential development could occur.
    - State and County roads would be subject to existing maintenance schedules and current use levels.

2. Air Quality

a. Impacts to air quality in and around the surface facility complex associated with disapproval of the proposed Project.

Current air quality impacts would continue to be the result of fugitive dust and vehicle exhaust emissions from operation of the PM Mine. The area should continue to be classified as attainment for all regulated pollutants.

The Agency concludes that impacts to air quality in and around the surface facility complex associated with disapproval of the proposed Project should be negligible.

b. Impacts to air quality along and around the rail spur associated with disapproval of the proposed Project.

Fugitive dust and vehicle exhaust emissions from agricultural operations and vehicle travel on local roadways would continue to generate air quality impacts. Regular train traffic would continue to pass through the Broadview area, generating diesel emissions. The area along the rail spur right-of-way should continue to be classified as attainment for all regulated pollutants.

The Agency concludes that impacts to air quality along and around the rail spur associated with disapproval of the proposed Project should be negligible.

c. Impacts to air quality from truck haulage of coal on U.S. Highway 87, Highway 312, and Heath Street.

Re-entrained dust and exhaust emissions from vehicular traffic should continue to constitute the sources for air quality impacts along U.S. Highway 87, Highway 312, and Heath Street. The area along these roadways should continue to be classified as attainment for all regulated pollutants. However, in 1993 reconstruction of 6.2 miles of U.S. Highway 89 is scheduled several miles south of the south entrance to Old Divide Road. During this 1-year reconstruction period, ambient fugitive dust (PM_{10}) concentrations and NO_2, CO, and particulate concentrations from exhaust emissions would show temporary increases along this portion of U.S. Highway 87.

The Agency concludes that impacts to air quality from truck haulage of coal on U.S. Highway 87, Highway 312, and Heath Street should be negligible to minor.

d. Impacts to air quality in and around the Huntley area associated with disapproval of the proposed Project.

Air quality impacts from fugitive dust and vehicle and locomotive exhaust emissions should continue as a result of regular train traffic and operational activities at the Huntley sugar beet loading site. The Huntley area should continue to be classified as attainment for all regulated pollutants.

The Agency concludes that impacts to air quality in and around the Huntley area associated with disapproval of the proposed Project should be negligible.

3. Geology

a. Impacts to stability of slopes and sandstone cliffs in and around the life-of-mine area associated with disapproval of the proposed Project.

Natural erosion and weathering will continue to occur with slope failure and rock toppling altering topography and drainage patterns in the area.

The Agency concludes impacts to the stability of slopes and sandstone cliffs in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

4. Topography

a. Impacts to topography of the surface facility complex associated with disapproval of the proposed Project.

Reclamation of Meridian's coal test pit would proceed according to the approved plan and the PM Mine would continue to operate according to an approved permit. With reclamation complete, postmining and test pit topography would be similar to adjacent premining topography.

The Agency concludes that impacts to topography of the surface facility complex associated with disapproval of the proposed Project would be negligible.

b. Impacts to topography in and around the life-of-mine area associated with disapproval of the proposed Project.

Natural processes and current management would continue to determine topographic changes in the area.

The Agency concludes that impacts to topography in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

c. Impacts to topography along the rail spur associated with disapproval of the proposed Project.

The 33-mile right-of-way would continue to be managed for grazing, crop production, wildlife habitat, and recreation. Natural processes and current management would continue to determine topographic changes in the area.

The Agency concludes that impacts to topography along the rail spur associated with disapproval of the proposed Project would be negligible.

5. Soils

a. Impacts to soil productivity associated with disapproval of the proposed Project.

The Huntley loadout and coal test pit would be reclaimed according to approved plans. The PM Mine would continue to operate, and land in and around the proposed mine would be maintained in current or proposed uses.

The Agency concludes that impacts to soil productivity associated with disapproval of the proposed Project would be negligible.

6. Hydrology

a. Impacts to ground and surface water supplies in and around the life-of-mine area associated with disapproval of the proposed Project.

Ground water and related surface water supplies would continue to be determined by climate, recharge, and natural structural changes in area.

The Agency concludes that impacts to ground and surface water supplies in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

b. Impacts to water quality in and around the life-of-mine area associated with disapproval of the proposed Project.

The quality of ground and surface water from spring and seep discharges, would continue to be determined by natural chemical and structural processes in the area.

The Agency concludes that impacts to water quality in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

c. Impacts to ground water supplies in and around the life-of-mine area associated with disapproval of the proposed Project.

Ground water supplies in deep aquifers would be impacted only by wells drilled for future development.

The Agency concludes that impacts to ground water supplies in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

d. Impacts to ground and surface water quality in sections 12 and 13 associated with disapproval of the proposed Project.

Natural chemical and structural processes in the area would continue to determine the quality of ground and surface water in sections 12 and 13.

The Agency concludes that impacts to ground and surface water in sections 12 and 13 associated with disapproval of the proposed Project would be negligible.

e. Impacts to ground water quality in the Huntley area associated with disapproval of the proposed Project.

The existing Huntley loadout would be reclaimed as planned. Because the facility is located in an industrial area, future uses could impact ground water quality.

The Agency concludes that impacts to ground water quality in the Huntley area associated with disapproval of the proposed Project would be negligible.

f. Impacts to alluvial ground water supplies in the Huntley area associated with disapproval of the proposed Project.

The existing Huntley loadout would be reclaimed as planned, and operations of the water supply well would depend on the future use of the site.

The Agency concludes that impacts to alluvial ground water supplies in the Huntley area associated with disapproval of the proposed Project would be negligible.

7. Vegetation

a. Impacts to wetland communities in and around the life-of-mine area associated with disapproval of the proposed Project.

Precipitation-dependent wetland communities throughout the area should continue to fluctuate in response to annual moisture patterns and continue to be susceptible to damage from wild and domestic animal grazing and watering.

The Agency concludes that impacts to wetland communities in and around the life-of-mine area associated with disapproval of the proposed Project would be minor.

b. Impacts to wetland communities along the rail spur associated with disapproval of the proposed Project.

The 1-acre precipitation-dependent wetland community in the right-of-way would not be disturbed and would continue to fluctuate in response to annual moisture patterns. New wetland communities would not be established along the proposed rail right-of-way.

The Agency concludes that impacts to wetland communities along the rail spur associated with disapproval of the Project would be negligible.

c. Impacts to the vegetative productivity and community stability along the powerline easement and rail spur associated with disapproval of the proposed Project.

Subdivision of real estate in the Bull Mountains would continue along with extreme overgrazing of some parcels. Increased population levels in the Bull Mountains could require powerline upgrading with or without the proposed Project. Grazing by domestic and wild animals would continue in the Bull Mountains, subject to landowner discretion. Vegetation productivity and stability along the proposed rail spur right-of-way could change radically upon termination of the Federal Conservation Reserve Program.

The Agency concludes that impacts to vegetative productivity and community stability along the powerline easement and rail spur associated with disapproval of the Project would be negligible to minor.

d. Impacts to vegetative productivity and community stability within the surface facility complex and the Huntley loadout associated with disapproval of the proposed Project.

The PM Mine would continue to operate within the terms of its permit and the 101 acres of existing disturbance eventually would be reclaimed. Vegetation productivity of the area would be a function of annual precipitation and landowner management practices. Huntley loadout would remain as a commercial-use area (see Appendix B) after reclamation of the existing pond according to the current permit.

The Agency concludes that impacts to vegetative productivity and community stability within the surface facility complex and Huntley loadout associated with disapproval would be negligible.

8. Wildlife

a. Impacts to tree- and cavity-nesting birds in and around the life-of-mine associated with disapproval of the proposed Project.

Tree- and cavity-nesting birds have an abundance of nesting habitat in the Bull Mountains, both within the life-of-mine area and around it. One hundred-one acres of the surface facility complex is already disturbed by PM Mine, and would be returned to usable habitat under the terms of the present permit.

The Agency concludes that impacts to tree- and cavity-nesting birds in and around the life-of-mine area associated with disapproval of the proposed Project would be negligible.

b. Impacts to sharp-tailed grouse nesting and brood-rearing habitat, turkey-roosting habitat, and mule deer winter range at the WDA associated with disapproval of the proposed Project.

The existing ponderosa pine-mixed grassland of the WDA sites would not be disturbed, and would continue to be used by sharp-tailed grouse for nesting and brood rearing, by wild turkeys for roosting, and by mule deer in winter.

The Agency concludes that impacts to sharp-tailed grouse nesting and brood-rearing habitat, turkey-roosting habitat, and mule deer winter range at the WDA associated with disapproval of the proposed Project would negligible.

c. Impacts to elk, deer, and antelope in the Bull Mountains area from increased human activity and development associated with disapproval of the proposed Project.

Proliferation of small housing tracts in the Bull Mountains could be a greater deterrent to some wildlife species, such as elk and deer, than a single larger block of human activity. Subdivisions could increase over a wider area. Twenty-acre homesteads, with associated domestic pets and daily traffic, influence wildlife in an area exceeding 20 acres. Assured water sources for wildlife associated with hydrologic mitigation would not be provided.

The Agency concludes that impacts to elk, deer, and antelope in the Bull Mountains area from increased activity and development associated with disapproval of the proposed Project would be negligible.

d. Impacts to the wildlife productivity within the life-of-mine area associated with disapproval of the proposed Project.

Current wildlife productivity is largely a function of weather (precipitation) patterns, grazing and foraging competition with livestock, and tolerance of landowners for specific species. Certain species also have limited tolerance for human activity. Increased subdivision would continue to affect wildlife. Wildlife populations and distribution would continue similar to present levels, affected primarily by landowner tolerance.

The aquatic animal community in the life-of-mine area would continue to be controlled by the fluctuations in the status of aquatic habitat provided by springs, seeps, and rainfall.

The Agency concludes that impacts to wildlife productivity within the life-of-mine area associated with disapproval of the proposed Project would be negligible.

9. Transportation

a. Impacts to traffic flow and public safety associated with disapproval of the proposed Project.

Truck and other vehicle trips generated by the PM Mine would continue to use Fattig Creek Road, Old Divide Road, and U.S. Highway 87. These vehicles would use a portion of the capacity of the area roadways and intersections.

Traffic volumes should continue to grow with general population increases in the area. More traffic volume and more vehicle-miles of travel would gradually reduce the LOS on area roadways and increase the number of accidents.

Traffic turning from either of the Old Divide Road/U.S. Highway 87 intersections onto U.S. Highway 87 would continue to yield to through traffic. Longer delays would occur at the intersections as a result of both traffic growth on U.S. Highway 87 and the PM Mine trucks turning to and from Old Divide Road. As delays increased, the LOS of the intersections would decrease.

More accidents would occur at the intersections of Old Divide Road with U.S. Highway 87. More vehicles and longer delays in traveling through the intersection would increase the potential for conflicts.

Truck travel along U.S. Highway 87 would slow when going up long, steep grades and would continue to impede traffic. Continued traffic measures combined with the slow trucks could lower the LOS of highway segments and cause more accidents.

Congestion due to highway reconstruction projects on U.S. Highway 87 would occur as vehicles traveled through highway work zones. The number of accidents would increase as vehicles stopped at the reconstruction sites. Reconstruction projects would result in a better roadway surface and shoulders and increase the traffic capacity and safety of the roadway.

The U.S. Highway 87/Highway 312 intersection would continue to be congested during the peak hours of travel. As traffic growth continued, congestion would worsen, reducing both the capacity and LOS of the intersection. Large trucks would continue to have a difficult time turning at the intersection and could further reduce its capacity and LOS. More traffic accidents would occur due to increased traffic and vehicle delays and stops.

The seasonal sugar beet traffic would continue to use Highway 312 and Heath Street to get to the Huntley stockpile facility (see Appendix B). The LOS of the Highway 312/Heath Street intersection could become worse during the short duration of sugar beet deliveries due to continued growth of traffic in the area. More traffic accidents would occur at the intersection due to the increased traffic and vehicle delays and stops.

The number of vehicle trips generated by resident along Heath Street is low. The continuation of sugar beet traffic along this road should create few conflicts and little congestion. Sight distance is good, so cars traveling in the Heath Street area would have adequate resources to avoid accidents with the sugar beet traffic.

The Agency concludes that impacts to traffic flow and public safety associated with disapproval of the proposed Project would be minor.

b. Impacts to traffic flow and public safety on public and private roads between U.S. Highway 87 and Montana Route 3 associated with disapproval of the proposed Project.

Traffic should continue to grow as the general population increases in the area. More traffic would reduce the capacity and potentially increase the number of accidents on public and private roadways between U.S. Highway 87 and Montana Route 3.

County and private roadways between U.S. Highway 87 and Montana Route 3 have low traffic volumes. Increased traffic could reduce the available capacity of these roadways. More traffic accidents would occur along these roadways and at intersections due to the increased traffic volumes.

Congestion due to highway reconstruction projects would occur. More stops and delays would be experienced as increased numbers of vehicles traveled through work zones. Completion of the reconstruction projects would result in a better roadway surface, better shoulders, and increased traffic capacity and safety of the roadway.

The Agency concludes that the impacts to traffic flow and public safety on public and private roads between U.S. Highway 87 and Montana Route 3 associated with disapproval of the proposed Project are negligible.

c. Impacts to the integrity/stability of County and State roads associated with disapproval of the proposed Project.

Traffic volumes should continue to grow as general population increases in the area. This growth would include automobile and heavy vehicle trips. Truck and vehicle trips generated by the PM Mine would continue to use Fattig Creek Road, Old Divide Road, and U.S. Highway 87. Seasonal sugar beet traffic would continue to use Heath Street and Highway 312.

The volume and makeup of this traffic would generate normal wear on the area road surfaces. This would increase the occurrence of pavement surface and structural failures. The continued growth of traffic on area roads would require increased maintenance and costs.

The continued travel of PM Mine coal trucks on Fattig Creek and Old Divide roads, and sugar beet trucks on Heath Street would continue to degrade road surfaces and structures. Pavement cracking, breakup, potholes, and rutting could be expected.

The Agency concludes that impacts to the integrity/stability of County and State roads from disapproval of the proposed Project would be minor.

d. Impacts to the integrity/stability of County roads from mining-related subsidence associated with disapproval of the proposed Project.

PM Mine would continue to operate within its permitted boundaries. Mining-related subsidence could result in settling of a small section of Fattig Creek roadbed. Subsidence could cause both travel surface and pavement structure failures.

The Agency concludes that impacts to integrity/stability of County roads from mining-related subsidence associated with disapproval of the proposed Project would be negligible.

10. Noise

a. Noise impacts in the Bull Mountains area associated with disapproval of the proposed Project.

Operation of the PM Mine would continue to produce noise levels that are currently experienced in the area. These levels range from about 40 to 72 dBA.

The Agency concludes that noise impacts in the Bull Mountains area associated with disapproval of the proposed Project would be negligible.

b. Noise impacts along the rail spur associated with disapproval of the proposed Project.

Along the proposed rail spur right-of-way, noise levels would remain near current levels. These levels range from 55 to 58 dBA at a 1,000 feet from noise sources. In the Broadview area, noise levels would continue to be influenced by Burlington Northern train traffic passing through the area.

The Agency concludes noise impacts along the rail spur associated with disapproval of the proposed Project would be negligible.

c. Noise impacts along the proposed coal transport route associated with disapproval of the proposed Project.

Noise levels along the proposed coal transport route would remain near current levels (i.e., L_{dn} values of 59 dB at a distance of 100 feet from roadways). However, in 1993, reconstruction of 6.2 miles of U.S. Highway 87 is scheduled. During the 1-year reconstruction period, noise levels would increase above current levels along this portion of the highway.

The Agency concludes that noise impacts along the proposed coal transport route associated with disapproval of the proposed Project would be negligible to minor.

d. Noise impacts in the Huntley area associated with disapproval of the proposed Project.

Noise levels in the Huntley area would remain at current levels. L_{dn} values would continue to range from 50 to 55 dBA at residences 100 feet from Heath Street and Northern Avenue. The normal train traffic and the operation of the beet-loading site during the period from October through January, would continue to cause local increases in noise levels.

The Agency concludes that noise impacts in the Huntley area associated with disapproval of the proposed Project would be negligible to minor.

11. Socioeconomics

a. Impacts to employment, personal income, and population associated with disapproval of the proposed Project.

Employment, personal income, and population should increase at rates as described in Chapter III. Local governments, businesses, and residents would not benefit from the projected increase in income and employment opportunities associated with construction and development of the Project.

The Agency concludes that impacts on employment, personal income, and population associated with disapproval of the proposed Project would be negligible. In foregone benefits, the Agency concludes that these impacts would be minor.

b. Impacts to public sector fiscal conditions associated with disapproval of the proposed Project.

Public sector fiscal conditions should remain at their present level of service as described in Chapter III. Local governments in Montana cannot legally increase property taxation to support additional services without corresponding increases in population or taxable valuation. Local, State, and Federal governments would not benefit from increased tax revenues from the proposed Project nor experience the added expenditures from increased services.

The Agency concludes that impacts on public sector fiscal conditions associated with disapproval of the proposed Project would be negligible. In foregone benefits, the Agency concludes that these impacts would be moderate to major.

c. Impacts to law enforcement agencies associated with disapproval of the proposed Project.

Agencies responsible for law enforcement in Roundup, Broadview, Shepherd, Huntley, and Billings areas are understaffed, a condition that would not change with disapproval of the proposed Project.

Other development proposed in the Billings area (see Appendix B) should not affect the Musselshell and Yellowstone County Sheriff's departments; however, the Billings Police Department may experience short-term impacts due to the in-migration of construction workers.

The Agency concludes that impacts to law enforcement agencies with disapproval of the proposed Project would be minor.

d. Impacts to housing in the Roundup and Billings areas associated with disapproval of the proposed Project.

Fewer houses would be rented in the area with disapproval of the proposed Project. Without new development and a subsequent reduction in demand for housing, some homeowners would not be able to rent or sell their houses as readily or obtain higher rental prices due to economic effects of supply and demand.

Other development may increase the shortage of rental housing and temporary living quarters in Billings during construction phases. Construction activities may last through the summer, a time when motels experience higher occupancy rates due to tourist travel. It is possible that construction workers occupying motel rooms over the construction phase would displace tourists seeking motel accommodations.

The Agency concludes that impacts on housing in the Roundup and the Billings areas associated with disapproval of the proposed Project would be minor.

e. Impacts to educational facilities associated with disapproval of the proposed Project.

Roundup Elementary School, Broadview Elementary and High schools, Shepherd Elementary School, and Huntley Project Elementary School are overcrowded. Accreditation standards to be implemented in 1992 will require smaller class sizes in kindergarten through second grade. With or without the Project, these standards may require additional educational facilities if newly-enrolled elementary students are not evenly distributed throughout the elementary grades.

Without the Project, school districts would not have the opportunity to apply for grants for school facility expansion through the Local Impact Assistance Program of the Montana Coal Board. School District officials would need to find other avenues to pay for additional classroom space.

Other development may add to the overcrowded conditions of Shepherd and Huntley school districts, areas close to proposed developments in Billings. It is expected that few in-migrating construction workers would bring their families with them to live for the short duration of construction activities. In addition, the largest portion of construction activities usually occurs during the warmer months of the year, a time when school usually is not in session.

The Agency concludes that impacts on educational facilities with disapproval of the proposed Project would be minor.

f. Impacts to social well-being in the Bull Mountains area associated with disapproval of the proposed Project.

Individuals perceiving the Project to be a negative influence on the area would view its disapproval positively, whereas those favoring it would perceive disapproval as reducing the potential for increased local income and jobs. Individuals who supported the Project may perceive that their quality of life had been adversely affected by the Project's denial. Anticipation of a much-needed boost to the economy would not be realized and would cause disappointment to many. This loss of an optimistic economic outlook for the community could decrease the feeling of social well-being for some people.

It is likely that community conflict among groups favoring or opposing the Project gradually would subside with no development, but interpersonal polarization would remain for years. Other development should not affect the social well-being in the Bull Mountains area.

The Agency concludes that impacts to social-well being in the Bull Mountains associated with disapproval of the proposed Project would result in moderately negative impacts for those who favor the Project, and moderately positive impacts for those opposing it.

g. Impacts to social well-being in the Huntley area associated with disapproval of the proposed Project.

Individuals perceiving the proposed loadout facility to be a negative influence on the area would view disapproval of the proposed Project positively, whereas those favoring the proposed loadout facility would perceive disapproval as negative. It is likely that community conflict among groups favoring or opposing the proposed loadout facility gradually would decrease, but interpersonal polarization would remain for years. Other development should not affect the social well-being in the Huntley area.

The Agency concludes that impacts to social-well being in the Huntley area associated with disapproval of the proposed Project would result in moderately negative impacts for those favoring the Project, and moderately positive impacts for those opposing it.

12. Recreation

a. Impacts to outdoor recreational opportunities in the Bull Mountains area associated with disapproval of the proposed Project.

Impacts to outdoor recreation activities currently exist from equipment noise, traffic, dust, and access restrictions in the vicinity of the PM Mine.

Extensive private landownership limits access to much of the Bull Mountains area for outdoor recreation purposes. Montana Department of Fish, Wildlife and Parks' big game hunting regulations warn hunters that access to private land may be difficult to obtain.

The Agency concludes that impacts to outdoor recreation opportunities in the Bull Mountains area associated with disapproval of the proposed Project would be negligible.

b. Impacts to outdoor recreational opportunities in the Huntley area associated with disapproval of the proposed Project.

The noise, dust, and traffic associated with the sugar beet loading site has impacted outdoor recreation activities for residents along the haul route since its inception. Safety for individuals engaging in dispersed recreation activities such as walking, jogging, and bicycling on Heath Street is jeopardized by the heavy truck traffic. Additionally, there is dust and noise associated with the loadout activities and the use of trains for hauling the beets to processing facilities.

The Agency concludes that impacts to outdoor recreation opportunities in the Huntley area associated with disapproval of the proposed Project would be negligible.

13. Land Use

a. Impacts to land use in the life-of-mine area associated with disapproval of the proposed Project.

Impacts to cropland and rangeland in the life-of-mine area would occur if more intensive farming, ranching, timber production, or land development took place. These activities are part of the existing conditions and a substantial increase in activity beyond the existing conditions would not be expected.

No impacts to buildings, corrals, fences, and roads beyond normal wear and tear would be expected.

There would be little impact to future development of the life-of-mine area beyond the existing constraints of topography, soils, utility availability, and access. Operations at the PM Mine would continue. PM Mine eventually would be reclaimed under conditions of its permit and returned to agricultural use. Subsidence would continue to occur, but on a smaller area than the proposed Project.

The Agency concludes that the impacts to land use in the life-of-mine area associated with disapproval of the proposed Project would be negligible.

b. Impacts to land use along the rail spur associated with disapproval of the proposed Project.

Impacts to cropland and rangeland in the rail spur right-of-way would only occur if more intensive farming, ranching, timber production, or land development took place. A substantial increase in activity beyond the existing conditions would not be expected. No impacts to corrals, fencing, and roads beyond normal wear and tear would be expected.

There would be little impact to future development of land along the rail spur right-of-way beyond existing conditions.

The Agency concludes that the impacts to land use along the rail spur associated with disapproval of the proposed Project would be negligible.

14. Visual Resources/Aesthetics

a. Impacts to visual resources/aesthetics in the life-of-mine area associated with disapproval of the proposed Project.

Impacts to visual resources/aesthetics could occur as a result of natural processes, such as fire, and human activities, such as increased ranching, farming, timber production, or land development. Substantial increases in human activities in the life-of-mine area would not be expected. PM Mine facilities would continue to impact the visual resources/aesthetics until it was reclaimed.

The Agency concludes that impacts to visual resources/aesthetics in the proposed life-of-mine area associated with disapproval of the proposed Project would be negligible.

b. Impacts to visual resources/aesthetics in the rail spur right-of-way associated with disapproval of the proposed Project.

Impacts on visual resources/aesthetics could occur as a result of natural processes, such as fire; and human activities, such as increased ranching, farming, timber production; or land development. Substantial increases in human activities in the rail spur right-of-way would not be expected. Trains would continue to operate on the Burlington Northern mainline through Broadview.

The Agency concludes that impacts to visual resources/aesthetics in the proposed rail spur right-of-way associated with the disapproval of the proposed Project would be negligible.

c. Impacts to visual resources/aesthetics in Huntley associated with disapproval of the proposed Project.

The proposed loadout site, located in a rail-served industrial area, could be developed for some other industrial use. If and how the area would be developed would determine the degree of impact to visual resources/aesthetics. The existing sugar beet loading site and rail line would remain in operation and would continue to impact the visual resources/aesthetics of the area.

The Agency concludes that the impact to visual resources/aesthetics in Huntley associated with disapproval of proposed Project could range from negligible to moderate.

15. Cultural Resources

a. Impacts to prehistoric and historic resources in the Bull Mountains area associated with disapproval of the proposed Project.

Prehistoric and historic resources are currently affected by natural processes such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Deforestation and intensive cultivation of agricultural land are examples of activities contributing to resource disturbance. Minor vandalism and some unauthorized artifact collecting would also continue to affect the resource base. However, such processes are a part of the present conditions and no demonstrable effects beyond the present conditions would be expected.

The Agency concludes that impacts to prehistoric and historic resources in the Bull Mountains associated with disapproval of the proposed Project would be negligible.

b. Impacts to Native American (traditional) resources in the Bull Mountains area associated with the disapproval of the proposed Project.

Native American resources are currently affected by natural processes such as erosion and fires; greater effects occur where human activities accelerate the natural processes. Intensive cultivation of agricultural land would contribute to resource disturbance. Minor vandalism at rock art sites would also continue to affect the resource base. However, such processes are a part of the present conditions and no demonstrable effects beyond the present conditions would be expected.

The Agency concludes that impacts to Native American (traditional) resources in the Bull Mountains associated with disapproval of the proposed Project would be negligible.

c. Impacts to undiscovered prehistoric, historic, and Native American (traditional) resources in the Bull Mountains area associated with disapproval of the proposed Project.

Undiscovered prehistoric, historic, and Native American resources are presently affected by natural erosion; greater effects occur where human activities accelerate the natural processes. Intensive cultivation of agricultural land would contribute to resource disturbance. Minor vandalism and some unauthorized artifact collecting would also continue to affect the resource base. However, such processes are a part of the present conditions and no demonstrable effects beyond the present conditions would be expected.

The Agency concludes that impacts to undiscovered prehistoric, historic, and Native American (traditional) resources associated with the disapproval of the proposed Project would be negligible.

C. COMPARISON OF ALTERNATIVES

Table IV-5 compares the Agency's conclusions regarding the intensity and duration of the Project's site-specific and cumulative impacts with those of the disapproval alternative.

TABLE IV-5
IMPACTS COMPARISON BY ALTERNATIVE FOR BULL MOUNTAINS MINE NO. 1

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
AIR QUALITY		
Impacts to air quality in/around the surface facility complex.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to air quality along/around rail spur.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to air quality from coal trucks on U.S. Highway 87, Highway 312, and Heath Street.	Minor to moderate over short term and negligible over long term.	Negligible impacts.
Impacts to air quality in/around Huntley area from the Huntley loadout.	Minor to moderate over short term and negligible over long term.	Negligible impacts.
GEOLOGY		
Impacts to stability of slopes and sandstone cliffs in/around life-of-mine area.	Minor over short term and negligible over long term.	Negligible impacts.
TOPOGRAPHY		
Impacts to the topography of surface facility complex.	Moderate to major over short term and minor to negligible over long term. Irretrievable loss of topographical diversity due to WDA.	Negligible impacts.
Impacts to topography in/around life-of-mine area.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to topography along the rail spur.	Moderate over short and long terms.	Negligible impacts.
SOILS		
Impacts to soil productivity in areas of mining-related surface disturbance.	Moderate to major over short term and minor over long term. Productivity losses under track ballast would be irretrievable.	Negligible impacts.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
HYDROLOGY		
Impacts to ground and surface water supplies in/around life-of-mine area from mining-related subsidence.	If mitigation met MSUMRA requirements and was successful, minor to moderate over short and long terms. If mitigation failed, an irreversible and irretrievable loss of some springs and intermittent stream reaches.	Negligible impacts.
Impacts to water quality in/around the life-of-mine area from subsidence.	Negligible to minor over short and long terms.	Negligible impacts.
Impact to ground water quality and quantity in/around life-of-mine area from well operation.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to ground and surface water quality in sections 12 and 13 from mine waste disposal.	Negligible to minor over short and long terms.	Negligible impacts.
Impacts to ground water quality in the Huntley area from loadout operation.	Negligible over short and long terms.	Negligible impacts.
Impacts to alluvial ground water supplies in the Huntley area from water supply well at the loadout.	Negligible over short and long terms.	Negligible impacts.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
VEGETATION		
Impacts to wetlands in/around life-of mine area.	If mitigation met MSUMRA requirements and was successful, moderate over short term and minor over long term. If mitigation failed, possible irreversible and irretrievable loss of the resource in the area of failed mitigation.	Minor impacts.
Impacts to wetlands along rail spur.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to vegetative productivity and stability along powerline and rail corridors.	Moderate to major over short term depending on revegetation success and weed invasion and negligible over long term. Irretrievable loss of productivity until reclamation was successful.	Negligible to minor impacts.
Impacts to vegetative productivity and stability within the surface facility complex and Huntley loadout.	Moderate over short term and negligible over long term. Irretrievable loss of productivity until reclamation succeeded.	Negligible impacts.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
WILDLIFE		
Impacts to tree- and cavity-nesting birds in/around life-of-mine area from subsidence.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to sharp-tailed grouse nesting and brood-rearing habitat, turkey habitat, and mule deer winter range from the WDA.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to elk, deer, and antelope in Bull Mountains area from increased human activity and mining-related activity.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to wildlife productivity within life-of-mine area from mining-related subsidence.	Minor over short term and negligible over long term. For aquatic animals, if the mitigation met MSUMRA requirements and was successful, minor to moderate over short term and minor over long term. If mitigation failed, an irreversible and irretrievable loss of aquatic animal resource in the area of failed mitigation.	Negligible impacts.
TRANSPORTATION		
Impacts to traffic flow and public safety along public highways from mining-related traffic.	Moderate and potentially significant in first 2 to 3 years. Negligible over long term.	Minor impacts.
Impacts to traffic flow and public safety from coal train traffic crossing roads.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to the integrity/stability of County and State roads from coal trucks.	Major and significant over short term and minor to moderate over long term.	Minor impacts.
Impacts to integrity/stability of County roads in the life-of mine area from mining-related subsidence.	Minor over the short term and negligible over long term.	Negligible impacts.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
NOISE		
Impacts to Bull Mountains area from noise.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts along the rails spur from construction and train noise.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts from coal truck noise along the coal-hauling route.	Minor to moderate over short term and negligible over long term.	Negligible to minor impacts.
Impacts to the Huntley area residents from noise due to construction and operation of Huntley loadout.	Minor to moderate over short term and negligible over long term.	Negligible to minor impacts.
SOCIOECONOMICS		
Impacts to employment, personal income, and population.	Minor and beneficial over short term and minor and negative over long term.	Negligible impacts. Foregone benefits minor.
Impacts to public sector fiscal conditions.	Minor and beneficial over short term and minor and negative over long term.	Negligible impacts. Foregone benefits moderate to major.
Impacts to law enforcement agencies.	Moderate during coal hauling to Huntley and then minor over short term. Negligible long term.	Minor impacts.
Impacts to housing in Roundup and Billings.	Minor over short term and negligible over long term.	Minor impacts.
Impacts to educational facilities.	Moderate and potentially significant over short term and negligible over long term.	Minor impacts.
Impacts to social well-being in Bull Mountains area.	Moderate and potentially significant over short term and minor long term.	Moderately negative impacts for those favoring the Project and moderately positive impacts for those opposing it.
Impacts to social well-being in Huntley area.	Moderate and potentially significant over short term and moderately positive over long term.	Moderately negative impacts for those favoring the Project and moderately positive impacts for those opposing it.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
RECREATION		
Impacts to outdoor recreational opportunities in the Bull Mountains.	Minor over short term and negligible over long term.	Negligible impacts.
Impacts to outdoor recreational opportunities in the Huntley area from Huntley loadout.	Minor over short term and negligible over long term.	Negligible impacts.
LAND USE		
Impacts to land use in the life-of-mine area.	Moderate over short term and minor over long term. For land uses associated with springs if mitigations met MSUMRA and were successful, minor to moderate over short term and minor over long term. If mitigations failed, an irreversible and irretrievable loss of the land use resource in the area of failed mitigation.	Negligible impacts.
Impacts to land use along the rail spur from construction and train traffic.	Moderate over short and long terms. Loss of agricultural productivity and other development would be irretrievable.	Negligible impacts.
VISUAL RESOURCE/AESTHETICS		
Impacts to visuals/aesthetics in the Bull Mountains area.	Minor to moderate over short and long terms. WDA would constitute an irretrievable commitment of visual/aesthetic resources.	Negligible impacts.
Impacts to visual/aesthetics in the Bull Mountains area from the rail spur.	Minor to moderate over short and long terms. Cuts-and-fills and structures would constitute an irretrievable commitment of visual/aesthetic resources.	Negligible impacts.
Impacts to visual/aesthetics from Huntley loadout.	Major and significant over short term and negligible over long term.	Negligible to moderate.

IMPACT TOPIC	ALTERNATIVE 1	ALTERNATIVE 2
CULTURAL RESOURCES		
Impacts to prehistoric and historic resources.	Impacts minor and permanent. Loss of NHRP-eligible sites would be irretrievable. Data recovery could be beneficial.	Negligible impacts.
Impacts to Native American resources.	Impacts minor, permanent, and potentially significant. Some potentially sensitive areas may be irretrievably disturbed.	Negligible impacts.
Impacts to undiscovered prehistoric, historic, and Native American resources.	Impacts moderate, permanent, and potentially significant and irretrievable.	Negligible impacts.

CHAPTER V

CONSULTATION AND COORDINATION, PUBLIC PARTICIPATION, AND REVIEW

A. CONSULTATION AND COORDINATION

In the course of processing Meridian's application for its proposed Bull Mountains Mine No. 1, the Agency consulted or coordinated with a variety of State, Federal, and local agencies.

- Montana Department of Fish, Wildlife and Parks was contacted to provide consultation on wildlife matters.
- Montana State Historic Preservation Officer was contacted regarding cultural and historic resources in the area.
- Montana Department of Transportation, Rural Planning Section, was contacted regarding impacts to roadways and transportation corridors.
- Montana Department of Health and Environmental Sciences was contacted regarding air and water quality issues.
- Montana Department of Labor and Industry, Billings Job Service Office, was consulted regarding labor statistics in the Project area.
- The Endangered Species Field Office (Helena, Montana), U.S. Fish and Wildlife Service (USFWS), was contacted regarding Federal threatened and endangered species that could inhabit or otherwise use the proposed Meridian mine permit, rail spur, and power line areas.
- Musselshell and Yellowstone County Sheriff's departments, Billings Police Department and Montana Department of Justice, Highway Patrol Division, were contacted regarding law enforcement and traffic impacts.
- School districts in Musselshell and Yellowstone counties were contacted regarding the impact of additional students to area schools and times of school bus routes on roadways proposed for use in hauling coal.
- Yellowstone County and the cities of Billings and Roundup were contacted regarding public works capacities and recreational facilities.
- Montana Department of State Lands, Hard Rock Bureau was consulted regarding the operation of the rock quarry.

- U.S. Department of the Interior, Bureau of Land Management (BLM) was contacted about land use permitting requirements within the WDA and coal-mining issues in the Bull Mountains area.

- Montana department of Natural Resources and Conservation was consulted about compliance with the Montana Major Facility Siting Act and other powerline issues.

- Montana Department of Justice, Fire Prevention and Investigation Bureau, State Fire Marshal was contacted regarding fire safety issues in and around the surface facility complex.

- Interstate Commerce Commission (ICC), Section of Energy and Environment, was contacted about regulatory requirements for the rail spur.

B. PUBLIC PARTICIPATION

A formal period for submitting written comments on the scope of the EIS analysis occurred from May 9, 1990, through July 9, 1990. A notice of intent to prepare an EIS on the Bull Mountains Mine No. 1 proposal was published in the May 9, 1990, Federal Register (55 F.R. 19365) and the Agency mailed 3000 brochures to households in the Roundup, Huntley and Broadview area. The notice and brochures included a description of the proposed Project, and a request for public participation in determining the scope of the issues to be addressed in the EIS. Seventy-nine comment letters on the scope of the EIS analysis were received. The Agency held two public meetings to obtain public input to the scoping process. Twenty people attended the first public meeting in Billings, Montana on June 11, 1990. Seventy-seven attended the second meeting, in Roundup, Montana on June 12, 1990.

Huntley Community Club sponsored 3 public meetings in Huntley, Montana to discuss various aspects of the proposal. Eighty-two people attended the first meeting, January 31, 1991. Montana DSL made a presentation and held a discussion on the permitting and EIS processes and the Project including the use of the Huntley loadout. Fifty-three people attended the second meeting, May 29, 1991. This meeting featured a presentation by Montana Department of Transportation on issues related to coal truck traffic, subsequent highway degradation, and use of the Huntley loadout. Fifty-eight people, including the Yellowstone County Commissioners, attended the third public meeting July 31, 1991. Montana DSL made a presentation, and discussion focused on the use of tax revenue for road maintenance, the use of the Huntley loadout, air quality, and general aspects of the Project.

The House Natural Resources Committee of the Montana House of Representatives held hearings on the Project in Helena, Montana on April 22, 1991, and January 9, 1992.

Numerous impact topics regarding Meridian's proposal were identified during these scoping activities. Many of these topics were evaluated as part of the impact analyses of the EIS in Chapter IV. Those topics not formally addressed are discussed in the following sections of this chapter along with the Agency's rationale for not including them in Chapter IV.

Commencing with the date of publication of the draft EIS, the Agency is opening a minimum 30-day comment period during which they will receive public comment on, and review of, this draft EIS. Written comments on the draft EIS will be accepted at the Agency's addresses shown on the cover sheet until the date indicated on the insert sheet in the front of this document. The Agency would appreciate receiving written comments as soon as possible.

The draft EIS will be available for public review at the Helena and Billings offices of Montana DSL. The addresses of these offices are listed on the cover sheet and in Chapter I.

The Agency will issue a final EIS on Meridian's proposal that will contain both corrections or clarifications of this draft EIS, and responses to comments received.

Montana DSL must make a decision whether to approve or disapprove Meridian's proposed Project no sooner than 15 days following public release of the final EIS.

C. PUBLIC ISSUES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

For various reasons, the Agency evaluated but determined not to address a few topics concerning the applicant's proposal that were identified by the public during scoping activities. A list of these topics, along with the Agency's rationale for not analyzing them, follows:

- Endangered or threatened wildlife or plant species protected by the Endangered Species Act of 1973.--

  On June 21, 1990, consultation was initiated with USFWS, regarding Meridian's permit application, by requesting a list of protected species from USFWS that could occur in the vicinity of the proposed Project. On June 29, 1990, USFWS responded with a list indicating that the Bald Eagle

(_Haliaeetus leucocephalus_,) Peregrine Falcon (_Falco peregrinus_,) and Black-footed Ferret (_Mustela nigripes_) constitute the protected species that could occur within and near the Project life-of-mine area, rail spur right-of-way, powerline easement, and Huntley loadout. An updated species list was requested on November 20, 1991, and USFWS confirmed the original list on December 13, 1991. On February 21, 1992, a biological assessment of these species was prepared. The assessment concluded that the proposed Project would not affect protected species named on USFWS's list. On March 3, 1992, USFWS concurred with the determination of no effect. Because no endangered or threatened wildlife or plant species would be affected by developing the proposed Project, the Agency did not identify and analyze probable impacts to such species.

- Permitting of coal-mining activity under the Montana Strip and Underground Mine Reclamation Act (MSUMRA) of 1973 as amended.--

The public expressed concern about the adequacy of the proposal, including the overall reclamation plan, the enforcement of reclamation after mining ceased, the monitoring of surface and ground water, and the replacement of water resources. These concerns were eliminated from specific analysis in this EIS because existing provisions in State law address each of the issues, and because the permit application package submitted by Meridian is assumed to be in compliance with all applicable State and Federal laws (see Chapter IV, Assumptions for Alternative 1).

MSUMRA was enacted on March 16, 1973 by the Montana State Legislature for the purpose of protecting the environment, conserving natural resources, demanding effective reclamation of all lands disturbed by the taking of natural resources, setting effective requirements and standards, providing for orderly development of coal resources, and providing proper State administration and enforcement in order to achieve these objectives. The Act requires that an operator desiring a permit shall file an application which shall contain a complete and detailed plan for the mining, reclamation, revegetation, and rehabilitation of the land and water to be affected by the operation. Such a plan must also provide a determination of the probable hydrologic consequences of coal mining and reclamation operations, both on and off the mine site, with respect to the hydrologic regime. Sufficient data on the mine site and surrounding areas must also be collected so that cumulative impacts on hydrology can be determined.

The Act also specifies that each applicant for a coal mining permit must file a surety bond payable to the State of Montana conditioned upon the faithful performance of the requirements set forth in the Act and in an amount not less than the total estimated cost to the State of completing the work described in the reclamation plan. Each operator granted a permit is required to reclaim and revegetate the land affected by an operation. As a condition to all mining permits, the Act also gives the regulatory agency the right of entry to all mining areas for the purpose of inspecting records, operations and monitoring equipment, as well as the authority to take appropriate enforcement actions if a coal-mining operation is found to be in violation of the Act. The specific roles and responsibilities of various State and Federal agencies involved in Project approval are described in Appendix D.

- Future coal markets for coal from the Bull Mountains Mine No. 1.--

  The public expressed some concerns about the coal market and its relation to Bull Mountains coal. Specifically they were concerned about the applicability of Federal "monopoly restrictions" to Meridian's mining activities, the potential markets for Bull Mountains coal, and the impacts of the western coal glut on the economic feasibility of underground coal mining in the Bull Mountains over the next 40 years. After identifying these issues, the Agency decided to eliminate them from further consideration because they relate to larger national issues that pertain to coal supply, demand, production or a competitive market system beyond the scope of this EIS. See Chapter I for a description of the scope of the EIS analysis.

- The Bull Mountains coal for land exchange.--

  Issues associated with the approval or disapproval of the Bull Mountains land exchange were analyzed in the BLM's Bull Mountains Exchange Final EIS (Bureau of Land Management 1990b). This EIS addressed the proposed exchange of 3,674.36 acres of Federal coal estate for 9,873.18 acres of high-value recreation and wildlife lands. The analysis also covered concerns the public had expressed regarding impacts to State royalty revenue losses if the proposed land exchange were finalized. BLM selected the proposed exchange action as its preferred alternative.

The Administrative Rules of Montana directs agencies to "tier" from program, policy, or plan EISs of broad scope to those of a narrower scope, to eliminate repetitive discussions, and to exclude issues already decided. Therefore, since the BLM's Bull Mountains Exchange Final EIS previously addressed issues associated with the land exchange and subsequent development of Federal coal resources in a large portion of the Bull Mountains area, the Agency have eliminated such issues from the current EIS analysis. See Chapter I for a more detailed description of the scope of the EIS analysis.

- Whitney Benefits Inc. and Peter Kiewit Sons' Company vs. U.S.--

The public raised the question of whether the Whitney Benefits legal decision applied to mining activity in the Bull Mountains. The legal decision addressed the issue of whether the U.S. Claims Court correctly concluded that the enactment of Surface Mining Control and Reclamation Act's (SMCRA) prohibition of surface mining of alluvial valley floors (AVFs) constituted a taking of the Whitney Benefits coal property in Sheridan County, Wyoming. The case dates from 1973 when Peter Kiewit Sons' Co. offered to buy mining rights to Whitney Benefits coal under an AVF. In December 1974 the 2 companies signed a lease giving Peter Kiewit Sons' the right to mine the coal in exchange for royalties. Peter Kiewit Sons' filed a permit application with the Wyoming Department of Environmental Quality.

The enactment of SMCRA on August 3, 1977 contained provisions specifying that surface mining could not "interrupt, discontinue, or preclude farming on AVFs that are irrigated or naturally subirrigated." Wyoming denied the permit application with the explanation that a large portion of the coal was under an AVF. After failing to agree on an acceptable exchange of lands with the U.S. Department of the Interior, the companies filed a complaint with the U.S. Claims Court, charging that SMCRA had deprived them of "all economically viable use" of their property. The Court ruled in favor of the companies and awarded them damages, finding that SMCRA "had a devastating economic impact on the companies' property." The decision was appealed unsuccessfully by the Federal Government.

After considering this issue, the Agency eliminated it from further analysis because the legal case of Whitney Benefits Inc. and Peter Kiewit Sons' Company vs. U. S. pertained to a government "taking" of coal property involving an alluvial valley floor, which related to a permitting application that happened to be pending at the time of the SMCRA enactment. The Whitney Benefits case is not believed applicable to mining activity in the Bull Mountains and, therefore, its impact is beyond the scope of the current EIS.

- Fiscal management of State and County governments in Montana.--

  The public voiced some concerns about the effect of the proposed Bull Mountains mining operation on State and County governments. These concerns related to whether the State would receive adequate reimbursement for the removal of coal from the region; whether staffing/pay levels at the Department of State Lands were adequate to ensure proper monitoring of the mining activity; and whether County operational problems, particularly in regard to road repair, would be exacerbated by the proposed mining activity. The Agency concluded that concerns of this type are related to the fiscal management of State and County governments rather than to the specific proposal to mine coal at Bull Mountains. Nothing in the proposed action would affect how the respective levels of government staff their departments, maintain pay scales, or budget and disburse funds for particular projects. Therefore, since all of these issues are beyond the scope of analysis for this EIS, the Agency did not attempt to identify and analyze associated impacts. See Chapter I for a full description of the scope of the EIS analysis.

- Management of private lands controlled by Meridian.--

  The public raised some concerns about Meridian's past, present, and future land management and development policies, along with concerns about economic impacts to local ranchers if Meridian canceled lease agreements. Reclamation and land use requirements set forth in MSUMRA provide adequate regulation of land management and development of disturbed land within the mine permit area during mine life. MSUMRA requires that postmining land use for a permit area must be grazing land for livestock and wildlife, fish and wildlife habitat, or both, unless alternate reclamation is approved by the regulatory authority. Meridian's future development and management of land that has not been disturbed within the permit area, and plans for privately controlled land outside of the proposed permit area, are unrelated to the proposed Bull Mountains Mine No. 1 and beyond the scope of the EIS analysis.

- Future development of the Bull Mountains Mine No. 1 life-of-mine area.--

  The public expressed concerns that future development of the Bull Mountains Mine No. 1 life-of-mine area could result in unanticipated environmental impacts. The concerns included questions about the disposal of fly/bottom ash and other hazardous waste material at the mine site, the impact if a mouth-of-the-mine power plant is constructed in the future, the impact if coal is mined elsewhere in the region from the same coal deposit, and the possible impacts from future petroleum exploration and extraction projects that might occur in the region. The majority of these concerns were found to be of a speculative nature, unconnected to any part of the proposed mining plan or to any event likely to occur in the foreseeable future.

  The environmental impact of handling and disposing of mine wastes in an unanticipated manner was considered as an alternative in Chapter II, but then eliminated from further analysis since it was found to be economically impractical and generally incompatible with the longwall method of coal removal. The construction of a power plant at the mine mouth was also dropped from the current analysis of issues since it is only speculation at the present time, and any future action regarding a power plant would require formal State and Federal approval and additional permits. The Agency could find no evidence to suggest that other operators intend to mine coal from the same deposits in the foreseeable future, so this issue was eliminated from further consideration. The concern about future petroleum exploration and extraction in the region was determined to bear little relevance to the proposed mining action and was also eliminated from further consideration. In summary, the Agency determined that there was insufficient evidence to suggest that any of these events might occur in the reasonably foreseeable future in or near the life-of-mine area and that an analysis of the potential impacts was beyond the scope of this EIS. See Chapter IV and Appendix B for a list of cumulative assumptions used by the Agency to perform the impact analysis. New projects would have to comply with all State and Federal laws including MEPA. Cumulative impacts of these projects would be addressed during environmental review.

- Future development of a chrome refinery by the Chrome Corporation of America and other mineral activity in the area.--

The Agency considered public concerns about impacts associated with the chrome refinery proposed to be built by the Chrome Corporation of America, east of Huntley, and also about impacts associated with an increase in other mining activity in Stillwater County. A preliminary analysis determined that the only measurable impact from either of these developments would be socioeconomic factors that could occur in the Billings area if related construction of facilities occurred at the same time as construction of the Project. If either or both of the other projects were concurrent with the construction of Bull Mountains Mine No. 1, there would be an increase in local population growth that could potentially impact social services, housing availability, school capacity, and other resources. However, construction of the chrome refinery is merely a proposal rather than a reality, and any concerns about the resulting impacts are based on speculation rather than fact. The Agency found no evidence to suggest that any increase in other mineral activity in Stillwater County is likely during the construction of proposed Bull Mountains Mine No. 1. Because these concerns are unrelated to the proposed mining plan or to events that are likely to occur in the reasonably foreseeable future, the Agency determined them to be beyond the scope of the EIS analysis.

D. REVIEW

This EIS has been mailed to all parties who have expressed an interest in receiving it. Additional copies of the document are available on request for a limited time from Montana DSL addresses shown on the cover sheet. Copies of the EIS were mailed to the following State and Federal agencies:

Montana College of Mineral Science & Technology

Montana State University

Montana Bureau of Mines & Geology

Montana Department of Agriculture

Montana Department of Commerce, Montana Coal Board

Montana Department of Fish, Wildlife & Parks

Montana Governor's Office

Montana Environmental Quality Council

Montana Intergovernmental Review Clearinghouse

Montana Department of Health and Environmental Sciences

Montana State Historic Preservation Office

Montana Department of Natural Resources and Conservation

Montana Department of Revenue

Montana Department of Transportation

University of Montana

Montana State Library

U.S. Bonneville Power Administration

U.S. Bureau of Indian Affairs

U.S. Bureau of Land Management

U.S. Bureau of Mines

U.S. Forest Service

U.S. Office of Surface Mining

U.S. Soil Conservation Service

U.S. Bureau of Indian Affairs

U.S. Fish & Wildlife Service

U.S. Geological Survey

U.S. Interstate Commerce Commission

U.S. Environmental Protection Agency

National Park Service

CHAPTER VI

PREPARERS AND CONTRIBUTORS

Name	Project Responsibility	Education
MONTANA DSL		
Robert P. Bohman	Geology/Cultural Resources	M.S., Natural Science/Geology, Wayne State University; B.A., Natural Science/Geology, Wayne State University
Michael J. DaSilva	Project Management	M.S., Biology, Eastern Washington University; B.A., Biology, Eastern Washington University
Patrick J. Driscoll	Air Quality	B.S., Environmental Engineering, Montana College of Mineral Science and Technology
Clinton P. Erb	Project Management (Interim)	M.S., Urban and Regional Planning, University of Illinois at Urbana; B.S., Environmental Sciences, Principia College
Henry C. Follman	Geotechnical Engineering	B.S., Geological Engineering, Montana College of Mineral Science and Technology
Thomas F. Golnar	Hydrology	M.S., Zoology (Aquatic Ecology), University of Montana; B.S., Watershed Sciences, Colorado State University
Shannon B. Heath	Wildlife	MLA, Landscape Architecture & Environmental Planning, Utah State University; B.S., Wildlife Biology, Colorado State University
Bonnie K. Lovelace	Management Overview	M.S., Earth Science, Montana State University; B.S., Mathematics, Purdue University; B.S., Geology, Indiana University
Craig W. Pagel	Civil/Geotechnical Engineering	B.S., Geological Engineering, University of Idaho
Steven M. Regele	Technical Advisor/Vegetation	M.S., Botany, Montana State University; B.S., Biology, Eastern Montana College
Peter G. Werner	Mining Engineering	M.S., Mining Engineering, Columbia University; B.S., Civil Engineering, Montana State University; B.S., Geology, Stanford University
Lynn R. Woomer	Technical Advisor/Soils	M.S., Forestry, Stephen F. Austin State University; B.S., Forestry, Southern Illinois University
MONTANA BUREAU of MINES AND GEOLOGY		
John R. Wheaton	Hydrologist	M.S., Environmental Science/Hydrology, University of Montana; B.S., Geology and Chemistry, University of Montana

Name	Project Responsibility	Education
TETRA TECH, INC.		
Fred E. Budinger, Jr.	Cultural Resources	B.A., Anthropology, State College, San Bernardino
Susan B. Bupp	Cultural Resources/ Paleontology	M.A., Anthropology, University of Wyoming; B.A., Anthropology, Wichita University
Michael A. Fillinger	Project Management (Interim)	B.S., Biology, Whitman College
Earl F. Griffith	Technical Assistance	M.S., Earth Science (Geology), Montana State University; B.S., Earth Science (Geology), Montana State University
Allan F. Kuser	Recreation	B.S., Environmental Sciences, Sacramento State University; A.A., Wildlife Management, Shasta College
Michael K. Hussey	Land Use/Visual Resources/ Aesthetics	Registered Professional Landscape Architect, Arizona/Colorado/Nevada/New Mexico
William B. Moreland	Air Quality/Noise	M.A., Meteorology, University of California, Los Angeles; B.A., Meteorology, University of California, Los Angeles
Thomas E. Meyer	Transportation Engineering	B.S., Civil Engineering, University of Notre Dame
Ted R. Turk	Project Management	Ph.D., Ecology, University of California, Riverside; B.A., Biology, Williams College
Donald D. Weber	Transportation	B.A., Civil Engineering, University of Delaware, Newark
SERGENT HAUSKINS & BECKWITH		
Eric B. Oswald	Geology/Soils/Topography/ Hydrology	Ph.D., Hydrology, University of Arizona; B.S., Agricultural Economics, University of Arizona
ECONOMIC CONSULTANTS NORTHWEST		
Richard E. Dodge	Economics	M.S., Statistics, Montana State University; B.A., Mathematics, University of Montana
Linda D. Priest	Social Resources	B.S., Criminal Justice/Sociology, University of Nebraska

Name	**Project Responsibility**	**Education**
ECON, INC.		
Robert E. Carroll	Vegetation/Wildlife	M.S., Applied Science, Montana State University; B.S., Applied Science, Montana State University
Robert L. Eng	Wildlife, Threatened & Endangered Species	Ph.D., Wildlife Management, University of Minnesota; M.S., Wildlife Management, Montana State University; B.S., Wildlife Management, South Dakota State University
Brian Sindelar	Vegetation/Wetlands	Ph.D., Range Ecology, University of Montana; M.S., Range Science, University of Idaho; B.S., Range Science, Montana State University
LISA BAY CONSULTING		
Lisa L. Bay	Editing	B.A., Environmental Planning, University of California, Santa Cruz
Nancy L. Horn	Word Processing	Undergraduate studies, Diablo Valley College
L.C. HANSON CO.		
Larry B. Redmond	Graphics	AutoCAD Intermediate Training

CHAPTER VII

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CHAPTER VIII

GLOSSARY

Above-grade crossing: Railroad route that runs via an overpass or bridge above a motor vehicle route.

Alluvial: Pertaining to material or processes associated with transportation or deposition by running water.

Angle of draw: In mining, the angle between limit line and a vertical reference line drawn from the edge of the mine area. The angle of draw is used to calculate the limit of subsidence beyond the boundaries of the mined area and is expressed in degrees from vertical above the edge of the mined area.

ANFO: Ammonia Nitrate Fuel Oil, used as a blasting compound in coal mining.

Annuals: Plants that complete their life cycle and die in 1 year or less.

Aquifer: A water-bearing layer of permeable rock, sand, or gravel.

At-grade crossing: An intersection of railroad and motor vehicle routes at ground level.

Backfilling and grading: The operation of refilling an excavation and finishing the surface.

Backstowing: The process whereby waste product from the mineral benefication plant (wash plant) is hauled or piped back into the underground voids created by mining. To place the coal waste rock back underground in the abandoned mine working.

Baghouse: An air pollution abatement device used to trap particulates by filtering gas streams through large fabric bags, usually made of glass fibers.

Bench face: The surface of an excavated area at some point between the material being mined and the original surface of the ground on which equipment can be set, moved, or operated.

Bentonite: A highly plastic clay that swells extensively when wet.

Berm: A strip of coal left in place temporarily for use in hauling or stripping, or a layer of large rock or other relatively heavy, stable material placed at the outside bottom of the spoil pile to help hold the pile in position. Also a mound of dirt to contain, control, or delineate.

Bond release: Return of a performance bond to the coal operator after the regulatory agency has inspected and evaluated the completed reclamation operations and determined that all regulatory requirements have been satisfied.

Borrow materials: Soil or rock dug from 1 location to provide fill at another location.

Borrow or fill areas: Places where earth material is removed or added for construction purposes.

Broadcast seeding: Scattering seed on the surface of the soil.

Bulkhead: A structure or partition to resist pressure. A wall.

Catchment: A reservoir or basin developed for flood control or water management for livestock and/or wildlife.

Clean coal: Coal that has been processed to remove impurities.

Coal jig: A device that separates coal from foreign matter by means of their difference in specific gravity in a water medium.

Coal loadout: Area/facility where coal is loaded onto some form of transport for delivery to market.

Coal preparation plant: A facility where coal is sized, cleaned and prepared for transport.

Coal refuse pile: Storage mound of coal waste material.

Coal reserve: The quantity of recoverable coal that is calculated to lie within given boundaries.

Coal rider seams: Thin, unmovable seam closely above a thicker, minable coal body normally only a few inches thick.

Coal waste: All the coal refuse from a mine.

Compressional recovery: As overburden rocks flex downward into the mined area they are acted on by tensile stress, which can cause elongation and cracking. As the mining face passes away from a point, the area of tensile stress moves away as well. As settling occurs, overburden rocks are acted on by compressional stress, which can cause shortening and closing of tensional phase cracks. Compressional recovery is the return of the rock column to its approximate state of premining stress and strain.

Continuous miner: A machine with a continuous excavating drum, used to extract coal from the face in room-and-pillar mining. It also loads that coal into cars or conveyors without the use of cutting machines, drills, or explosives.

Deformation zone: The uppermost zone of subsidence-related deformation that can develop above a mined area is called the "deformation zone". The overburden rocks in this zone sag downward without major fracturing, thus their lateral continuity is maintained. The rocks can pull apart or separate along bedding planes. The deformation zone generally extends from the top of the fractured zone to the ground surface.

Detonating cord: A cord manufactured by explosives companies that burns at a rate of thousands of feet per second, creating the effect of an explosion (violent shock and loud report).

Disturbed area: An area where vegetation, topsoil, or overburden is removed or upon which topsoil, spoil, and processed waste is placed as a result of mining.

Diurnal: Relating to or occurring in the daytime.

Dozer-tracked: Having operated a bulldozer on the surface of an area for the purpose of packing down the soil to firm the seedbed, to cover seed, and to impede wind erosion.

Drill seeding: A mechanical means of planting seed in relatively narrow rows.

Drop trailers: Trailers that are loaded with supplies and deposited at locations where the supplies will be used. The trailers serve as storage units on site until a time when supplies are used, and then are retrieved.

Edaphic: Having to do with the influence of soils on living things, particularly plants, including human use of land for plant growth.

Effluent limitations: Regulatory standards that apply to the discharge or outflow of water from ground or subsurface storage.

Energy dissipators: Device/structure used to reduce the velocity/energy of flowing water.

Ephemeral stream: A stream that flows only in direct response to rainfall and snowmelt events; having no baseflow.

Evaporation pond: An impoundment area where water is retained and allowed to evaporate.

Exploration holes: Boreholes drilled into the ground while searching for coal deposits.

Extensometers: An instrument for measuring minute deformations of test specimens caused by tension, compression, bending, or twisting.

Eyrie: The nest of a bird on a cliff or mountain top.

Fractured zone: The intermediate zone of subsidence-related deformation that can develop above a mined area is called the "fractured zone". Overburden rocks in this zone fracture and deform as they sag downward into the mined area, but still maintain their lateral continuity. Rocks can pull apart or separate along bedding planes. The fractured zone can extend upward above the mined area to a height that is 50 times greater than mining height.

Fragmented zone: The zone of subsidence-related deformation that can develop immediately above and within a mined area is called the "fragmented zone". Overburden rocks in this zone fragment, cave, and rotate as they collapse into the mined area. The fragmented zone can extend upward above the mined area to a height that is 10 times greater than mining height.

Full-seam recovery: Entire section of seam is dislodged by mechanical mining methods and the coal is separated from the rock outside of the mine by the cleaning plant.

Geotechnical responses: Processes which change the properties of soils, including compaction, freezing, groundwater lowering, and injection.

Grubbing: Removing vegetation and other material from a surface area prior to mining or mining-related disturbance.

Harrowed: Cultivated and smoothed soil done with an implement equipped with spikes, teeth, or disks.

Head of fill: Upper limit of a material fill.

Head-of-hollow filling: The placement of overburden material from mines in compacted layers in narrow, steep-sided hollows so that surface drainage is possible.

Heavy media bath: Dense chemical solution used to remove rock contaminants while cleaning coal.

Heterogeneities: Dissimilar ingredients or constituents.

Highwall: The unexcavated face of exposed overburden and mineral on the bank of the uphill side of a strip-mining excavation.

Hydraulic conductivity: A measure of the ease with which water moves through soil or rock; permeability.

Incised: Having a margin that is deeply and sharply notched.

Joint: Fracture in rock, generally more or less vertical or transverse (lying across), along which no movement has occurred.

Lek: An assembly area where animals, especially grouse, carry on display and courtship behavior.

Life-of-mine: Length of time from permitting to final bond release during which coal can be extracted and mine-related activities can occur.

Limit line: The limit line is a straight line drawn from the edge of the mine area to the limit of measurable subsidence at ground surface.

Longwall mining: A method of mining whereby most of the coal is mined and the roof is allowed to cave in behind the miners as work progresses.

Longwall panel: The vertical face that is left intact as longwall mining work progresses toward the boundary of the mine.

Mass wasting: A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly.

Mesic: Moderately moist.

Micro climate: The essentially uniform climate of a small site or place.

Micro relief: Small topography.

Mine waste disposal area: Designated place within the mine permit area, and approved by the regulatory authority, where coal processing waste and underground development waste is disposed of in a controlled manner.

Mitigation: Rectifying an impact by repairing, rehabilitating, or restoring the affected environment.

Natural reinvasion of species: The migration and re-establishment of organisms into former habitat, without human assistance.

Net swell factor: "Net swell factor" or "bulking factor" is the volumetric increase of fragmented rocks relative to their undisturbed and in-place volume. The bulking factor is controlled by the size and shape of broken rocks, geometry of the cave zones, contact stresses among rock fragments, and relative strengths of affected rocks.

Nonerodible velocities: The speed at which water can travel without surface erosion.

Non-slaking rock: Earth material that does not crumble and disintegrate when exposed to air or moisture.

O and M: Operation and maintenance.

Opportunistic species: A species that can adapt to, and take advantage of, a variety of habitats or situations. This ability provides a benefit to the species in its distribution, numbers, and survival during changing conditions.

Overburden: Material of any nature that overlies a coal deposit, excluding topsoil.

Particulate emissions: Finely divided solid or liquid particles discharged into the air in the form of dust, smoke, fumes, mist, spray or fog.

Pascal: A pascal is a unit of pressure in the metric system and is defined as a newton/meter^2, where newton is a unit of force with units of kilogram x meter/second^2.

Passerine: The largest order of birds, including most songbirds.

Perched water table: Ground water contained above an impermeable bed and underlain by an unsaturated zone.

Perennial stream: A stream that flows throughout the year.

Perennials: Plants that live longer than two years.

Permanent seed mixes: Blends of seeds used to revegetate an area for final reclamation.

Portal: The entrance to a mine.

Postmining land use: The specific use or management related activity to which a disturbed area is restored after completion of mining and reclamation.

Postmining topography: The relief and contour of the land that remains after mining has been completed.

Potentiometric surface: An imaginary surface representing the total head of ground water and defined by the level to which water will rise in a well. A water table is a particular potentiometric surface.

Precipitation event: A quantity of water resulting from drizzle, rain, snow, sleet, or hail, in a limited period of time.

Radial stacker: A machine used to stack coal in a radial arc.

Raise boring: The process of drilling (boring) a raise (vertical shaft) from the bottom up. First a vertical hole is drilled from the surface down into the mine workings. The cutter heads (boring machine) are brought into the underground mine workings. The rotary table (rotating mechanism) is placed over the hole at the surface, and the cutter heads are connected to the rotary table by a long pipe. As the cutting heads are rotated and pulled upward, earth is cut and falls back into the underground mine workings where it is hauled out to the surface or placed somewhere else in the mine.

Raptors: Birds of prey (e.g., hawks, owls, vultures, eagles).

Reclaim system: A system of tunnels and conveyor belts built beneath the coal storage pile for moving the coal out of the pile and onto transport units (trains or trucks).

Reclaim tunnel: A tunnel used to retrieve coal from storage above.

Recontouring: The movement of quantities of earth, usually by mechanical means, to reconfigure the relief and contour of the land.

Replacement wetlands: Lands created through human intervention to replicate the original wetland area, where the water table is usually at or near the surface.

Revegetation: Plant growth that replaces original ground cover following land disturbance.

Ripping: The act of mechanically breaking compacted soils or rock into pieces small enough to be economically transported by other equipment such as a scraper or dozer.

Riprap: A layer of broken rock, cobbles, boulders, or fragments of sufficient size and thickness to resist the erosive forces of flowing water.

Rock check dams: A dam of loose rock usually dumped in place, often with the upstream part constructed of hand-placed or derrick-placed rock and faced with rolled earth or with an impervious surface of concrete, timber, or steel.

Room-and-pillar mining: A method of mining that involves mining out rooms and leaving pillars of coal for overhead support.

Run-of-mine (ROM): Pieces of unprocessed coal removed from a mine.

Salvaging depth: The distance below land surface from which soil can be retrieved.

Sandstone lenses: Many of the sandstones associated with coal seams were deposited by fluvial (river) processes. This type of sandstone tends to be longer in one direction than in the other. The elongated axis is parallel to, while the shorter axis is perpendicular to, the direction of water flow in the ancient river. In cross section, fluvial sandstones appear to be lens-shaped and often are surrounded by finer-grained rocks such as siltstones and shales.

Scoria (clinker): Baked and fused rock resulting from in-place burning of coal deposits.

Sedimentation pond: A structure such as a barrier, dam, or excavated depression that slows down runoff for the purpose of allowing sediment to settle out.

Seep: An extensive line or surface seam where water emerges from the ground as contrasted with a spring where water emerges from a localized spot.

Seral stage: Developmental stage in the natural sequence of plant communities.

Small depressions: Shallow basins of limited size on the land surface that may retain moisture.

Spoil stockpile: A supply of waste material that is gradually accumulated as overburden is removed during mining.

Spring enhancement: A process that improves the quality/quantity of a source of water issuing from the ground.

Stilling basin: An open structure or excavation at the foot of an overfall, chute, drop, or spillway to reduce the energy of the descending stream.

Strain: Deformation resulting from an applied force. In mining, strain is one type of deformation caused by the downwarping of overburden rocks into the mined area. Horizontal strain is the ratio of the change in length of the ground surface to its original length that is caused by curvature. This can be extended (defined as positive) or shortening (described as negative). Surface strain caused by subsidence is one of the primary causes of damage to structures at the surface.

Strata: A single sedimentary bed or layer, of any thickness.

Stratabound: A mineral deposit confined to a single layer, bed or stratum.

Subsidence: A surface depression over, and created by, underground mining.

Suspension waters:

Syncline: A trough of stratified rock in which the beds dip toward each other from either side.

Temporary seed mixes: Blends of seeds used to revegetate an area for a limited period of time prior to final reclamation.

Tensile strain: A normal stress that tends to pull apart materials on opposite sides of a real or imaginary plane.

Tilt: In mining, tilt (or change of slope) is one type of deformation caused by the downwarping of overburden rocks into the mined area. Tilt is the change of vertical displacement with respect to unit horizontal distance of the original ground surface. Tilt between two points of measurement along a subsidence profile can be calculated using data collected by subsidence monitoring and the following equation:

$$M_t = \frac{S_{t+1} - S_t}{X_{t+1} - X_1} = \frac{\Delta S_1}{1}$$

where X_{t+1} and X_1 are the two points, Δ is the first descending finite difference of tabulated vertical displacements at these two points and 1 is the distance between the two points, which is a constant that is small enough such that the curved surface over the interval can be approximated by a straight line. Tilt caused by subsidence is one of the primary causes of damage to structures at the surface.

Toe of the final slope: Bottom portion of an incline after mining-related disturbance has been completed.

Topsoil/subsoil stockpile: Soils that are removed prior to mining and gradually accumulated for reclamation and revegetation once mining is completed.

Tube stacker: A machine that stacks coal in a conical pile.

Underburden: Material of any nature, consolidated or unconsolidated, that underlies a coal deposit, excluding topsoil.

Underground reclaim: A tunnel that is used for removing waste material from a mine.

Ungulate: An animal having hooves.

Unit train: Generally, a train of 100 coal cars. Each car holds 100 tons for a total of 10,000 tons being moved in each unit train.

Unsuitable material: Material that fails Montana DSL standards for use in reclamation, or placement within an aquifer.

Vegetation sampling: The selection of a number of plants (a sample) from a larger number of plants (the universe).

Wildlife habitat: A geographical area that can provide for the key activities of wildlife.

Windrow: A row of hay raked up to dry before baling.

APPENDIX A

SUMMARY DESCRIPTION
OF THE PROPOSED
BULL MOUNTAINS MINE NO. 1
AND ASSOCIATED FACILITIES

A. INTRODUCTION

Meridian Minerals Company (Meridian) proposes to develop the Bull Mountains Mine No. 1, an underground coal mine located along the southern boundary of Musselshell County, about 35 miles northeast of Billings, Montana, and 16 miles southeast of Roundup, Montana (see Figure I-1). Support facilities for the proposed mine would be located throughout Musselshell and Yellowstone counties. The proposed Project has 5 elements: 1) the mine; 2) a temporary upgrade of the existing Montana Rail Link rail loadout near Huntley; 3) a proposed 33-mile rail spur from the Burlington Northern mainline south of Broadview; 4) a 17-mile upgrade and extension of the Fergus Electric Cooperative power transmission line from the City of Roundup; and 5) limited wetland enhancement activities outside the mine area (see Figure I-2). The Bull Mountains Mine No. 1 and its support facilities (the Project) , would occupy about 12,115 acres, and would eventually disturb about 8,250 of those acres. (Table I-1).

The proposed mining operation would convert the existing PM Coal Mine and portions of the adjacent coal test pit site into a full-scale underground mining facility. (Specific details of the existing PM Mine facility and coal test pit are included in Appendix B.) The total life of the proposed mine (life-of-mine) would be about 44 years: 2 to 3 years for premining development, rail spur construction, equipment installation, and limited coal production; 30 years to recover about 100 million tons of clean coal; 1 year to complete reclamation activities; and 10 years to obtain final bond release (Table I-2). The majority of the production, varying from 0.5 to 3.3 million tons of clean coal per year, would be shipped to both domestic and foreign consumers. In addition, the mine would continue to supply the small, local market currently served by the PM Mine.

(Table A-1 contains legal descriptions for Project components.)

1. Bull Mountains Mine No. 1

The life-of-mine area for the proposed mine would contain a total of 10,859 acres of private, State, and Federal lands (Table I-1), of which 7,041 surface acres could be disturbed by mining-related activities.

About 871 acres of the life-of-mine area would be occupied by a surface facility complex to service the mining operation. The facility would disturb 770 acres beyond the 101 acres previously disturbed by the PM Mine and coal test pit.

TABLE A-1

Legal Descriptions of the Proposed Bull Mountains Mine No. 1 and Associated Facilities

1. Bull Mountains Mine No. 1 *

Township 6 North, Range 26 East, Montana Principal Meridian:
sections 12 through 14; and
Township 6 North, Range 27 East, Montana Principal Meridian:
sections 3 through 5, 7 through 11, and 14 through 23.

2. Huntley loadout

Township 2 North, Range 27 East, Montana Principal Meridian:
section 25.

3. Bull Mountains rail spur **

Township 4 North, Range 23 East, Montana Principal Meridian:
sections 13, 14, 22, 23, 26, 27 and 34;
Township 4 North, Range 24 East, Montana Principal Meridian:
sections 12 through 18;
Township 4 North, Range 25 East, Montana Principal Meridian:
sections 5 through 7;
Township 5 North, Range 25 East, Montana Principal Meridian:
sections 1 through 3, 9, 10, 16, 21, 28, 29, 31, and 32;
Township 5 North, Range 26 East, Montana Principal Meridian:
Section 6; and
Township 6 North, Range 26 East, Montana Principal Meridian:
sections 15, 20 through 22, 29, 31, and 32.

4. Fergus Electric power transmission line **

Township 6 North, Range 26 East, Montana Principal Meridian:
sections 3, 4, 10, 11, 13, and 14;
Township 7 North, Range 25 East, Montana Principal Meridian:
sections 1 and 12;
Township 7 North, Range 26 East, Montana Principal Meridian:
sections 7, 8, 17, 20, 21, 28, 32, and 33; and
Township 8 North, Range 25 East, Montana Principal Meridian:
sections 22, 23, 26, 27, 35, and 36.

5. Wetland enhancement activities **

Township 6 North, Range 27 East, Montana Principal Meridian:
section 5, 7, 13, 23, 25, 27 and 29; and
Township 7 North, Range 27 East, Montana Principal Meridian:
Section 35

* = Figures include rail and powerline acreages inside the life-of-mine area.
** = Figures reflect only those acreages outside of the life-of-mine area.

About 6,154 acres of the life-of-mine area could experience some surface subsidence caused by proposed underground mining activities. About 93 acres, potentially affected by subsidence, would also be disturbed by exploratory drilling (50 acres), hydrologic mitigation (43 acres) activities, and associated temporary road construction.

Outside the area subject to disturbance from subsidence, an additional 6 acres of the life-of-mine area would be disturbed by ventilation shaft installation and another 10 acres would be disturbed by hydrologic mitigation activities.

Mining operations could eventually employ 300 workers (Table I-3). Construction activities would employ about 38 workers over a 2- to 3-year period.

2. Huntley Truck Haul and Loadout

Proposed construction at Huntley would expand the capability of the existing low-volume coal loadout. Coal would be temporarily stockpiled and loaded; up to 1.1 million tons of clean coal per year during the 2- to 3-year period of permanent facility and rail spur construction at the proposed mine. The existing loadout occupies about 6 acres of private land (Table I-1) adjacent to the Montana Rail Link mainline. (Specific details of the existing Huntley loadout facility are included in Appendix B.) The expanded activities at the facility would not disturb any more acreage. Coal would be hauled by truck about 41 miles over County and State roadways from the proposed mine to the upgraded loadout.

Loadout activities could eventually employ 12 workers and truck-haul operations, 50 workers (Table I-3). Expansion (construction) activities would employ about 12 workers over a 2- to 3-month period.

3. Bull Mountains Rail Spur

The proposed 33-mile rail spur and associated right-of-way outside the life-of-mine area, would occupy about 1,160 acres of private and State land (Table I-1) between the Burlington Northern mainline and the proposed mine. Proposed road relocation activities would involve about 10 acres of new road construction within the rail right-of-way and abandonment of about 5 acres of existing roadbed outside the rail right-of-way.

Rail spur construction activities would employ about 26 workers over a 2- to 3-year period (Table I-3).

4. Fergus Electric Power Transmission Line

The 10-mile easement for the existing Fergus Electric power transmission line, between the city of Roundup and the Roundup substation, occupies about 36 acres of private and State lands (Table I-1). Three acres of this land could be disturbed when the existing line was upgraded to 69 Kv. The 7-mile right-of-way for the installation of new 69 Kv powerline from the Roundup substation to the proposed coal mine occupies about 27 acres of private and State land outside the life-of-mine area (Table I-1). About 13 of these acres could be affected by upgrade/extension activities. Fergus Electric Cooperative and would employ about 12 workers over a 2- to 3-month period for this work (Table I-3).

5. Wetland Enhancement Outside the Mine Area

Wetland enhancement activities are proposed at certain water sources outside the life-of-mine area, away from the mine site and associated disruptive activities (see Wetland Mitigation and Enhancement). These would constitute a 9-acre enhancement "bank" of wetland resources to temporarily mitigate Project-related wetland losses during mining operations. Impacts to existing springs and seeps and associated wetlands that might result from mining-related subsidence, would be mitigated gradually as reclamation operations progressed. The enhancement "bank" may remain as postmining wetland acreage even though other wetlands had been re-established. Enhancement activities outside the life-of-mine area would disturb about 22 acres of private land (Table I-1). Construction activities for wetland enhancement would occur throughout the mine life, using existing mine employees. The employees used should receive certified wetland restoration/construction training.

B. SURFACE FACILITIES AT THE MINE

The majority of surface facilities for the proposed mine would be centrally located on 391 acres of private land in sections 13 and 14 of T. 6 N., R. 26 E. in the western portion of the life-of-mine area (see figures I-3 and A-1). A mine waste disposal area (WDA) and its associated roads, stockpiles, and sediment ponds would be developed on an additional 480 acres of both private (379 acres) and Federal (101 acres) lands in sections 12 and 13, north and east of the main facilities area. A proposed 9-acre rock quarry would be developed in Section 12 within the boundary of the WDA. Ventilation shafts would be developed on 6 acres of private land in sections 11, 19, and 23 of T. 6. N., R. 27 E., west of the main facilities area.

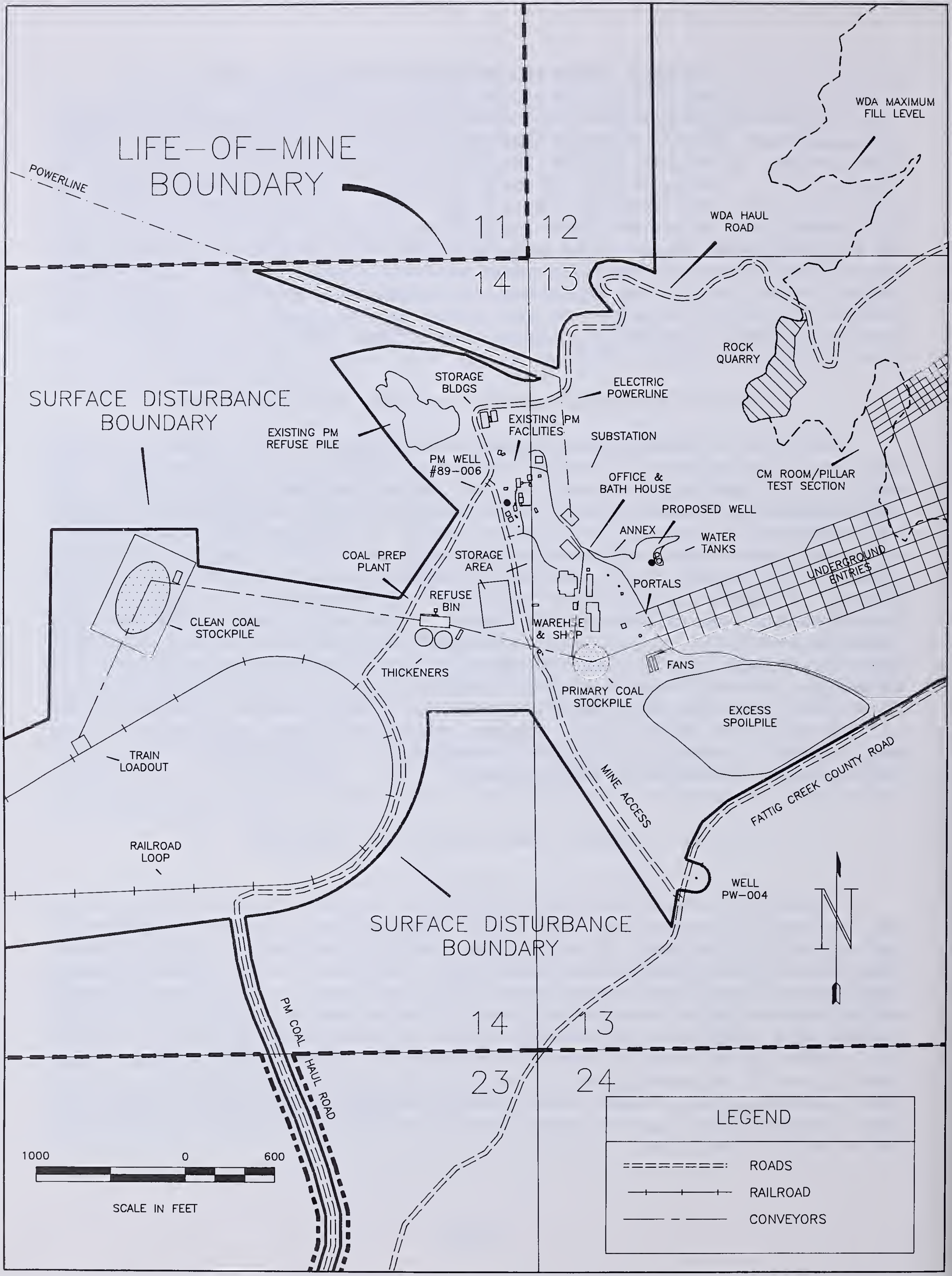

LIFE–OF–MINE BOUNDARY
POWERLINE
11
12
14
13
WDA MAXIMUM FILL LEVEL
WDA HAUL ROAD
ROCK QUARRY
SURFACE DISTURBANCE BOUNDARY
STORAGE BLDGS
ELECTRIC POWERLINE
EXISTING PM REFUSE PILE
EXISTING PM FACILITIES
SUBSTATION
PM WELL #89–006
OFFICE & BATH HOUSE
CM ROOM/PILLAR TEST SECTION
PROPOSED WELL
ANNEX
WATER TANKS
COAL PREP PLANT
STORAGE AREA
PORTALS
UNDERGROUND ENTRIES
REFUSE BIN
CLEAN COAL STOCKPILE
WAREHSE & SHOP
FANS
THICKENERS
PRIMARY COAL STOCKPILE
EXCESS SPOILPILE
TRAIN LOADOUT
MINE ACCESS
FATTIG CREEK COUNTY ROAD
RAILROAD LOOP
WELL PW–004
SURFACE DISTURBANCE BOUNDARY
N
PM COAL HAUL ROAD
14
13
23
24
1000
0
600
SCALE IN FEET
LEGEND
ROADS
RAILROAD
CONVEYORS

Figure A-1 Phase 2 production facilities

Mine development and coal production would occur in 2 phases, each with its own processing facility requirements. Existing coal processing facilities for the PM Mine and Huntley loadout would be upgraded over an initial, 2- to 3-month period to support initial mine development activities and limited (Phase 1) coal production. Installation of the permanent (Phase 2) support facilities would begin after completion of Phase 1 and would require about 2 to 3 years to complete.

1. Main Facilities Buildings

A limited amount of coal would be removed during early development (Phase 1) of the mine (about 0.5 to 1.1 million tons of clean coal per year). This coal would be processed at the existing PM Mine facilities and shipped from the Huntley loadout. Three to 4 custom mobile trailer units would be transported to the mine site to house temporary office administration, warehouse, and training facilities.

Phase 2 production would require the construction of a variety of pre-engineered steel and/or concrete block structures located on concrete foundations (see Figure A-1). A combined administration office, training facility, and bathhouse would occupy a single building in the central portion of the main facilities area. A combined shop and warehouse building would be designed to provide large and small equipment repair with inside storage of spare parts. A mine rescue and ambulance building would include a training center for emergency-response personnel and parking for an ambulance and emergency fire fighting equipment. An annex (storage) building would provide covered storage for large parts and bulk materials along with a fenced storage yard. Other equipment parking and storage would be provided throughout the area. A single, coal-fired boiler, centrally located in the office/training/bathhouse building, would supply space heating and hot water for that building as well as the shop/warehouse, mine rescue/ambulance, and preparation plant buildings. Heating and hot water in other areas of the mine complex would be supplied with individual electric or propane units.

2. Coal Processing Facilities

Phase 1 coal handling would use all of the existing facilities from the PM Mine. Coal would be conveyed from the mine to a 30,000-ton run-of-mine (ROM) stockpile near the portal area. Initially, coal would be transferred from the ROM stockpile to a raw coal stockpile near the preparation plant with front-end loaders and haul trucks. Eventually, as production levels increased and Phase 2 schedules allowed, the underground reclaim system and covered conveyor would replace the front-end loader/truck haul operation. Coal would be washed at the preparation plant and stored in an adjacent stockpile. Coal would be weighed at the mine before shipment.

Phase 2 coal-handling activities would use new, high-volume facilities. As in Phase 1, coal would be conveyed from the mine to the 30,000-ton, ROM stockpile near the portal area. An underground reclaim would transfer the coal to a covered conveyor for transport to a 1,200 ton-per-hour (TPH) preparation plant. Coal preparation would begin by crushing the ROM material to 4" size; waste material would be removed by heavy media separation. A covered conveyor would transfer the clean coal to a 100,000-ton capacity storage area. Two underground reclaim systems would transfer clean coal to a covered conveyor for transport to the unit-train loadout facility. Waste material would be stored in an 700-ton bin at the coal preparation plant before being transported by truck to the WDA.

Particulate emissions generated by the screening, crushing, and cleaning operations in the coal preparation plant would be controlled by fabric filters in the baghouse, during both phases 1 and 2. Water sprays would be installed on all coal crushing equipment and at all conveyor transfer points. All permanent conveyors outside the mine portal would be partially enclosed to limit particulate dispersion by wind. In order to control both dust and spillage in the coal stockpiles, the feed conveyors would discharge to tube stackers. Open coal stockpiles would be sprayed with water as necessary. Any coal stockpile fires would be extinguished promptly.

3. Ancillary Facilities

Ancillary facilities would include fuel and lube oil storage, explosives storage, wastewater treatment, power transmission, and solid waste storage. They would also include communications, water supply and distribution, and fresh air ventilation.

The fuel and lube oil storage system includes 4 refueling stations and 3 service centers located throughout the main facilities area. Refueling stations would consist of elevated diesel and/or gasoline fuel tanks installed within a concrete structure or berm made of impermeable material for spill containment. The containment structures would be capable of holding the entire tank volume, plus 25 percent.

Explosives used at the mine would include stick dynamite, boosters, ANFO, blasting delays, blasting caps and detonating cord. A secured explosives storage area would be located near the Administration Annex building. Equipment would include drop trailers for transport of the blasting agents and 2 skid-mounted explosive magazines, with dynamite and blasting caps safely separated.

Electric power used by mining equipment and coal-handling facilities would be delivered to an electrical substation located in the eastern portion of the main facilities area by Fergus Electric Cooperative. The substation would include dual transformers (1 for standby) and switchgear to convert incoming 69 Kv supply to lower voltages used throughout the facilities and mine area.

The communications network would include telephone service to the main facilities area furnished by U.S. West Communications. A private mine communications network would be installed throughout the mine operations area. Underground telephone service, currently located on the north shoulder of Fattig Creek Road, south of the main facilities area, would be extended along the access road to the mine. Where appropriate, both telephone and mine communication distribution lines would be installed parallel to the mine's electric distribution network.

The water supply and distribution system would be designed to furnish up to 400,000 gallons of water per day (gpd), at a maximum rate of 400 gallons of water per minute (gpm), for operational water requirements. It would also furnish up to 10,000 gpd, at a maximum 100 gpm, for potable water requirements at the mine. The operational supply system would consist of two 8,000-foot wells (1 operational and 1 standby) drilled into the Madison Formation in the eastern portion of the main facilities area, a deep well pump, two 100,000-gallon raw water storage tanks, a high-pressure pump station, and a watermain network. The potable supply system would use 4 existing, shallow (less than 200-feet deep) wells drilled into the Fort Union Formation by the PM Mining Company in the central and southern portion of the main facilities area, and a 10,000-gallon potable water treatment system and storage tank. Potable water for personnel would be transported throughout the mine in small containers.

The wastewater system would include facilities for the collection and treatment of sewage and washwater. Sewage effluent flow at the mine during full production is estimated to be less than 20,000 gallon per day (gal/d). Wastewater would be treated at a 20,000 gal/d package waste treatment plant located in the central portion of the main facilities area. Wastewater would be delivered to the treatment plant via pressurized pipes. Treated effluent would be discharged into the raw-water storage tanks for use at the mine facilities. Washdown waters from the facilities and suspension waters and coal dust washwaters would be collected in the evaporation ponds located throughout the main facilities area. Solids would be removed from the ponds and transported by truck to the WDA, as needed.

Ventilation facilities for the mine would involve 2 main fans (1 operational and 1 standby) capable of delivering up to 475,000 cubic feet of fresh air per minute throughout the mine. The air supply system would use the main mine entries in the portal area and 3 fresh air ventilation shafts to the surface, located throughout the life-of-mine area. Each shaft, equipped with water-tight linings, would require up to 2 acres of surface disturbance. Excavated materials would be removed through the mine by raise boring and stored in an excess waste pile. The entire disturbed area would be enclosed by a 7-foot, chainlink fence. These shafts would be equipped to serve as emergency escapeways for workers.

Solid waste would be stored temporarily throughout the main facilities area. Waste lumber, garbage, and other debris would be placed in covered storage containers for periodic disposal at a licensed commercial solid waste disposal facility. Waste grease, lubricants, paints, and flammable liquids would be stored in steel drums near the shop/warehouse for periodic disposal at a licensed and bonded liquid waste disposal facility.

The entire surface facility complex would be surrounded by barbed-wire fencing to limit public access. Existing fences would be used as much as possible. About one-half mile of new fence would be constructed along the north side of Fattig Creek Road in Section 13. Another 1 mile of new fence would be constructed in Section 12 around the WDA.

4. Storm Water and Sediment Control Facilities

a. Sedimentation ponds

Nine temporary sedimentation ponds would be constructed throughout the surface facility complex to contain runoff from mine development and production activities (see Figure A-2). The main facilities area would have 6 ponds; 2 near the ROM coal stockpile, 2 in the facilities area, 1 near the coal preparation plant, and 1 below the clean coal stockpile. The WDA would have 2 ponds, and the rock quarry 1 pond. Drainage areas above the temporary ponds in the main facilities area and the rock quarry would range from 3 to 39 acres. Drainage areas above the 2 WDA ponds would be 206 acres and 66 acres, respectively.

All sedimentation ponds would be designed to contain runoff from disturbed areas during a 10-year, 24-hour precipitation event.

They would be self-dewatering through the use of weep holes that would allow inflow to accumulate, suspended solids to settle, and water to discharge slowly, with an average containment time greater than 24 hours. Temporary impoundment spillways would be designed to safely pass the excess water flow from a 25-year, 24-hour runoff event, depending on the purpose of the impoundment. Accumulated sediment would be removed from ponds when sediment storage capacities were filled to 60 percent.

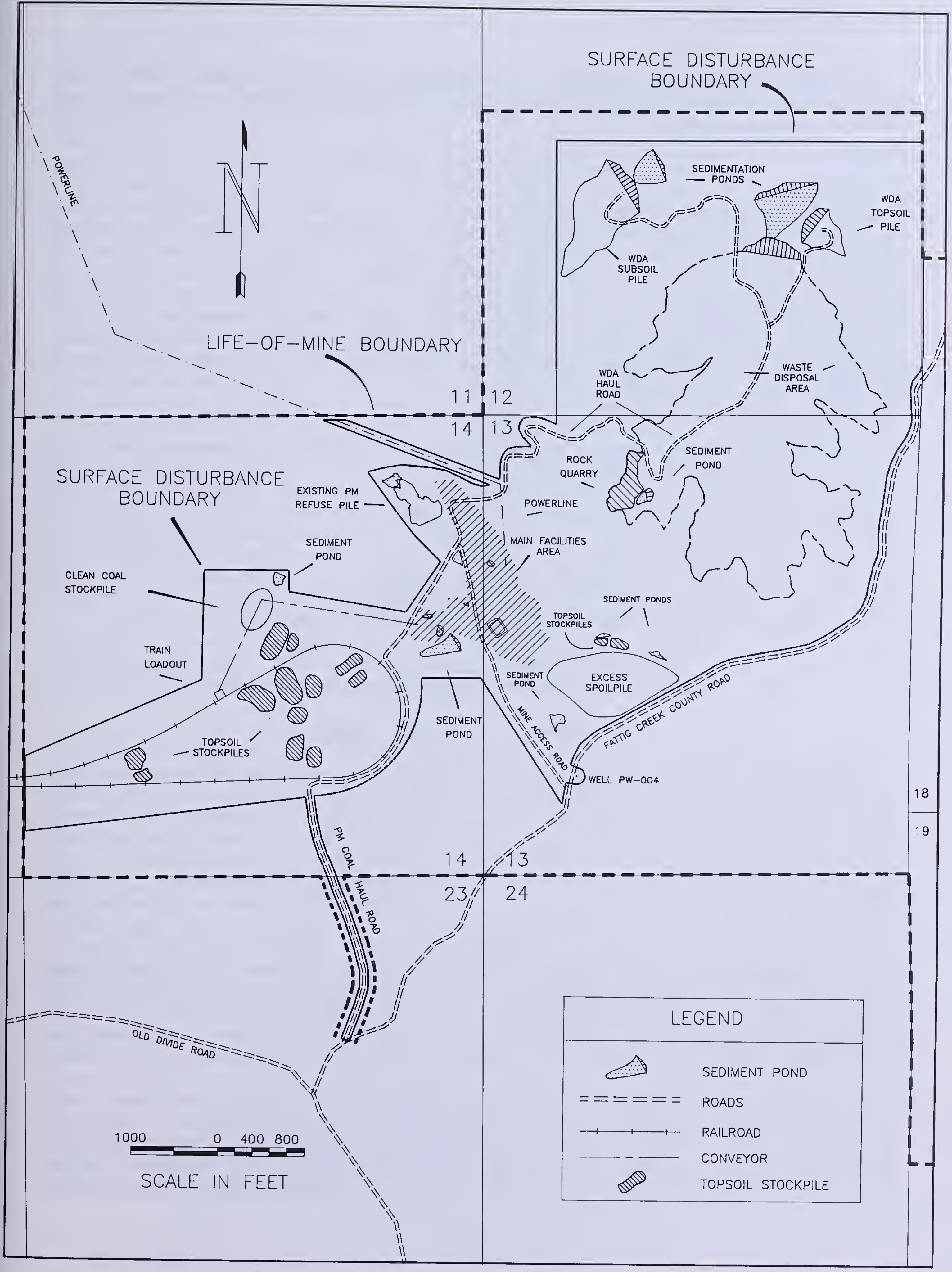

SURFACE DISTURBANCE BOUNDARY
POWERLINE
N
SEDIMENTATION PONDS
WDA TOPSOIL PILE
WDA SUBSOIL PILE
LIFE-OF-MINE BOUNDARY
WDA HAUL ROAD
WASTE DISPOSAL AREA
11
12
14
13
SEDIMENT POND
ROCK QUARRY
SURFACE DISTURBANCE BOUNDARY
EXISTING PM REFUSE PILE
POWERLINE
MAIN FACILITIES AREA
SEDIMENT POND
CLEAN COAL STOCKPILE
SEDIMENT PONDS
TOPSOIL STOCKPILES
TRAIN LOADOUT
SEDIMENT POND
EXCESS SPOILPILE
SEDIMENT POND
MINE ACCESS ROAD
FATTIG CREEK COUNTY ROAD
TOPSOIL STOCKPILES
WELL PW-004
18
19
PM COAL HAUL ROAD
14
13
23
24
OLD DIVIDE ROAD
LEGEND
SEDIMENT POND
ROADS
RAILROAD
CONVEYOR
TOPSOIL STOCKPILE
1000
0
400
800
SCALE IN FEET

Figure A-2 Surface facility complex

Ponds would be removed and reclaimed within 1 year after the areas they controlled achieved sufficient revegetation to make the ponds unnecessary.

b. Diversion ditches

Temporary diversion ditches (channels) would be used to route natural runoff around active mine support areas (including ventilation shaft facilities) and to collect and intercept runoff from disturbed areas for routing to either sedimentation ponds or into natural drainages, as appropriate. Side ditches would be used along the roads, conveyor corridors, and other linear structures (such as the rail spur). All channels would be grass-lined, trapezoidal or triangular, generally at slopes of one-half to 1 percent, and sized to safely pass the water flow from a 10-year, 24-hour precipitation event.

Temporary sand bags, straw bales, or rock check dams would be placed in ditches and other drainages to reduce flow velocities and minimize erosion. More durable riprap, energy dissipators, and stilling basins would be used in steeper sections where additional erosion protection may be required. Corrugated metal pipe or concrete culverts would be used at all diversion channels and natural drainage crossings (e.g., access and mine roads and the rail spur). All culverts would be designed to safely pass water flow from a 10-year, 24-hour precipitation event.

5. Material Borrow and Disposal Facilities

a. Waste disposal area

A WDA for mine development and coal waste from the preparation plant would be developed on 480 acres north and east of the main facilities area (see Figure A-2). Eventually, the WDA would cover 169 acres, containing about 19,000,000 tons of waste material. About 19 percent of the ROM coal removed during the first 2 to 3 years of Phase 1 coal production is expected to be waste (258,000 tons per year), while 13 percent of the ROM coal removed during the 30 years of Phase 2 coal production is expected to be waste (493,000 tons per year). (NOTE: Increased efficiency of Phase 2 coal preparation facilities compared to Phase 1 facilities decreases the amount (percentage) of waste material per ton of ROM coal.) Mine development waste, not related to that from the coal preparation plant, is expected to represent less than 10 percent of the total waste that would be deposited in the WDA over mine life.

Construction and filling the WDA would occur throughout the 33-year period of active mining. An underdrain system, of non-slaking, rock 16-feet deep and 16-feet wide, would be installed along the natural drainage from the head of the fill to the toe of the final slope. Rock side drains, 8-feet deep and 16-feet wide, would be installed throughout the WDA to direct flows to the main underdrain. Waste material would be spread over the area in maximum 2-foot lifts and compacted to at least 90 percent dry density. Coal processing waste, due to its high moisture content, would be allowed to air dry prior to compaction. Material eventually would reach a maximum height of about 140 feet at some locations within the WDA. After final elevations were reached, topsoil would be respread and the entire area revegetated.

b. Rock quarry

A rock quarry would be developed on about 9 acres within the WDA (see Figure A-2). The quarry would supply about 150,000 cubic yards of material for the underdrain at the WDA and for surfacing the roads throughout the active mine area. Rock would be mined by drilling and blasting. Dozers would move it to a small, portable, crushing facility for proper crushing and sizing. Material would be transferred to the WDA with front-end loaders and haul trucks.

C. OTHER FACILITIES

1. The Huntley Loadout

The proposed coal-loadout activities at Huntley would use the existing power, water, and road facilities from the Montana Rail Link operation. (Specific details of the existing Huntley loadout facility are included in Appendix B.)

Haul trucks would dump clean coal from the proposed mine into a 50-ton hoppered product bin (truck dump bin). The coal would be transferred from the bin to the main stockpile by a medium-capacity radial stacker using a 250-foot belt conveyor and flexible chute. The 30,000-ton stockpile (about 600 feet long, 200 feet wide, and 25 feet high) would parallel the railroad tracks (see Figure A-3). Coal would be transferred into rail cars through a 375-foot reclaim tunnel, using a medium-capacity, 25-foot by 100-foot belt conveyor and flexible chute.

A mobile trailer unit may be placed on the site to house temporary office facilities. Potable water would be provided from the existing Huntley water line on the property. An existing, 20-foot well drilled into the unconsolidated alluvial deposits would be used to furnish up to 30,000 gal/d of raw water for equipment washdown, service water for machines, and dust control. A water spray system would be installed to control dust on the access roads and coal stockpile. Electrical power would be provided from existing powerlines on the property. An existing pole-mounted transformer would be upgraded to accommodate increased power requirements. Chemical toilets, regularly serviced by an authorized sanitation company, would be provided for use by the

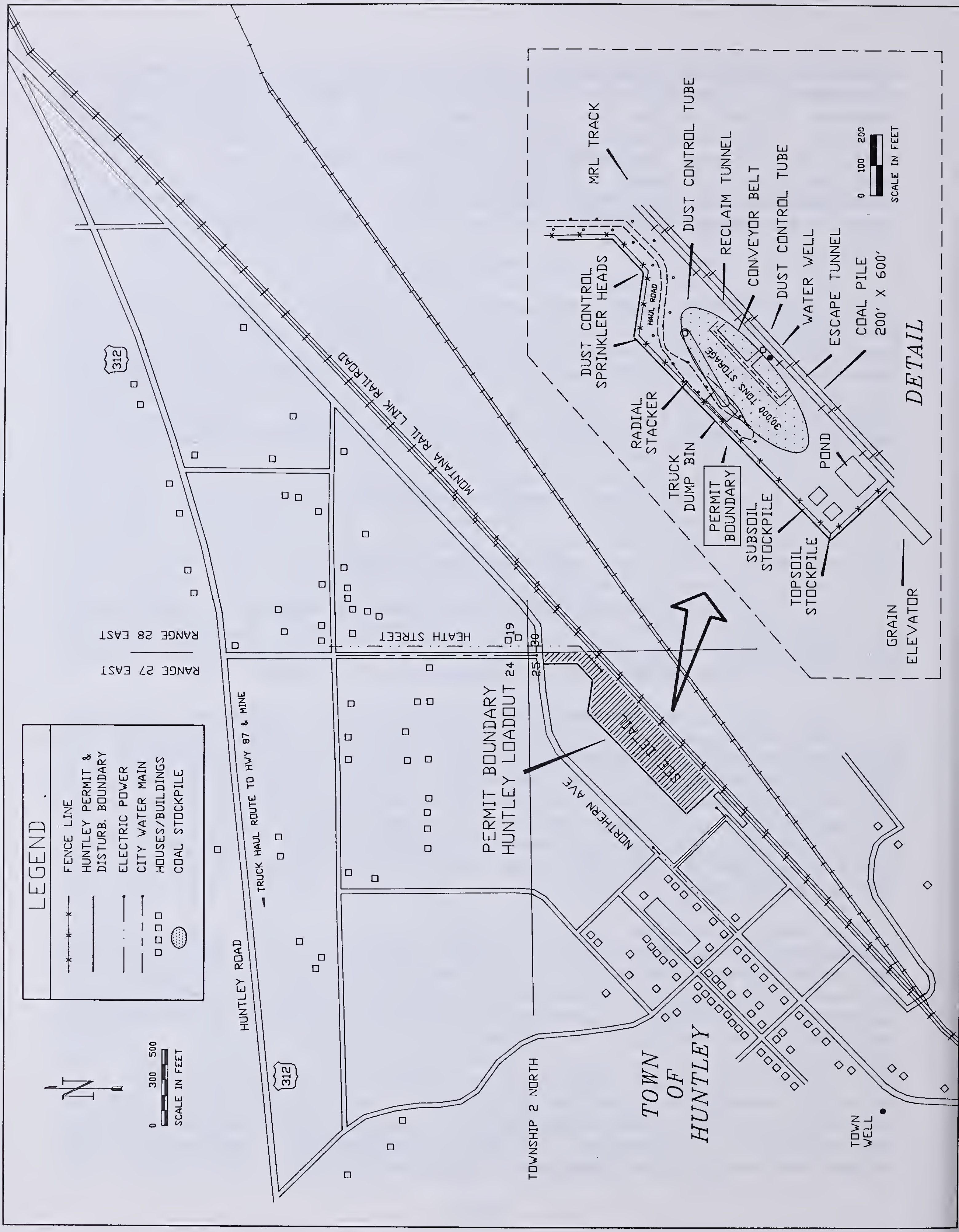

LEGEND
FENCE LINE
HUNTLEY PERMIT & DISTURB. BOUNDARY
ELECTRIC POWER
CITY WATER MAIN
HOUSES/BUILDINGS
COAL STOCKPILE
0 300 500
SCALE IN FEET
N
HUNTLEY ROAD
TRUCK HAUL ROUTE TO HWY 87 & MINE
312
312
RANGE 28 EAST
RANGE 27 EAST
HEATH STREET
19
30
25
24
PERMIT BOUNDARY
HUNTLEY LOADOUT
MONTANA RAIL LINK RAILROAD
NORTHERN AVE
SEE DETAIL
TOWNSHIP 2 NORTH
TOWN OF HUNTLEY
TOWN WELL
MRL TRACK
DUST CONTROL TUBE
RECLAIM TUNNEL
CONVEYOR BELT
DUST CONTROL TUBE
WATER WELL
ESCAPE TUNNEL
COAL PILE
200' X 600'
DUST CONTROL
SPRINKLER HEADS
HAUL ROAD
30,000 TONS STORAGE
RADIAL STACKER
TRUCK DUMP BIN
PERMIT BOUNDARY
SUBSOIL STOCKPILE
TOPSOIL STOCKPILE
POND
GRAIN ELEVATOR
0 100 200
SCALE IN FEET
DETAIL

Figure A-3 Upgraded Huntley loadout

staff. Equipment would be maintained and refueled off site. This site would be enclosed on 3 sides with an 8-foot wood or wood-like fence to limit vehicular and pedestrian access. Access along the south side of the operations area would be limited by the rail siding. Gates would be closed and the area patrolled during prolonged idle periods.

2. The Fergus Electric Power Transmission Line

The proposed upgrade and extension of the Fergus Electric power distribution network would use the existing facilities as much as possible. (Specific details of the existing Fergus Electric system are included in Appendix B.)

About 10 miles of the existing 50 Kv power distribution system between Roundup and the Roundup substation would be upgraded to 69 Kv service (see Figure I-2). The Roundup substation is located in Section 21 of T. 7 N., R. 26 E. along U.S. Highway 87, northwest of the main facilities area for the Project. The upgrade would include replacement of the 50 Kv wire and insulators. About 15 support poles would be replaced or modified within the 30-foot easement and a new transformer and new switchgear would be installed at the substation.

About 7 miles of new single-pole, overhead power transmission line would be built to extend 69 Kv service to the proposed mine from the Roundup substation (see Figure I-2). This extension would require the use of rubber-tired tractors and backhoes to install new, 40-foot support poles within the 30-foot easement and string the new powerline. The existing 7.2-Kv local distribution line would be maintained throughout the route, with new 69 Kv service placed at the top of the new poles and the existing service built beneath.

D. ROADS AND RAILROADS

Travel within the life-of-mine area and along the rail spur right-of-way would be restricted to established roads, except where necessary for maintenance, safety, and exploration work. Speed would be limited to 25 miles per hour (MPH) on all roads. All mine-facility roads and parking areas would receive regular applications of water or other approved dust suppressants. Yard areas and parking lots would be graveled or paved.

1. Primary Access Roads

The proposed mine complex would be accessible from the north and south by U.S. Highway 87, a 2-lane paved road that connects

U.S. Highway 12 (near Roundup) to the Billings area. (Specific details of U.S. Highway 87 and proposed reconstruction activities are included in Appendix B.) Old Divide Road, a 2-lane paved County road that makes an approximate 7-mile loop to the east off of U.S. Highway 87, and Fattig Creek Road, a 2-lane, all-weather-gravel County road, provide primary access to the Poject area (see Figure I-2).

2. Main Access Roads

The mine access road would connect the surface facility complex to Fattig Creek Road about 1.5 miles east of its junction with Old Divide Road (see Figure A-2). For security purposes, this road would be the only public access to the mine complex and would be controlled by a gate at its junction with Fattig Creek Road. The 36-foot-wide gravel road would be designed to carry daily volumes of up to 300 passenger vehicles and 100 commercial vehicles at speeds of up to 25 MPH.

Heavy service vehicles may occasionally use the existing PM Coal Road to reach the main facility complex (see Figure A-1). This road would be controlled by a gate at Fattig Creek Road.

3. The WDA Haul Road

A 2-mile gravel road would connect the main facilities area with the rock quarry and WDA (see Figure A-2). Off-road, 50-ton, end-dump trucks would be used to transport waste material to the WDA and rock from the quarry. The 36-foot-wide road would be designed with 15-foot-wide shoulders to carry daily volumes of up to 30 trucks at speeds of up to 25 MPH. Four-foot rock berms would be installed at the edge of fill/drop sections of the road. Shoulder width would increase to 25 feet when substantial cuts-and-fills were required for road construction.

4. Light-use Roads

Existing light-use gravel roads and 2-track trails would be used for mining-related activities, as necessary. Temporary roads would be constructed throughout the life-of-mine area for specific activities such as exploratory drilling, ventilation-shaft construction, pond and ditch maintenance, hydrologic mitigation, monitoring, reclamation, and inspection. These roads, when requiring formal construction or upgrade, could have a road surface up to 10 feet wide, with shoulders up to 10 feet wide on each side. After completion of a specific activity, these roads would be reclaimed by backfilling and regrading stored topsoil material, and reseeding.

5. The Bull Mountains Rail Spur

A proposed 33-mile rail spur would be used to connect the mine to the existing Burlington Northern rail system (see Figure I-2). (Specific details of the existing Burlington Northern system are included in Appendix B.)

Meridian proposes to purchase private lands for the right-of-way and secure use agreements for State parcels. Right-of-way for the rail spur would range from 150 to 500 feet wide, including a 10-foot fire guard on each side of the track. Public access would be controlled along the entire right-of-way, outside the life-of-mine area, with barbed-wire fences on both sides. The loadout loop at the mine and the mainline siding at Broadview are within secured areas and would not be directly fenced. Construction design calls for an equal balance of cut-and-fill, requiring about 6 million cubic yards of excavation. No other supplementary borrow or fill areas are proposed.

The proposed rail spur design includes 2 highway crossings: an "above-grade" crossing (see Figure A-4) of U.S. 87, near its junction with Majerus and Old Divide roads; and an "at-grade" crossing (see Figure A-5) of Montana Route 3, about 2 miles south of Broadview. In addition, existing County and private use roads in the area would be crossed 24 times: 4 County roads would be crossed "above-grade" (see Figure A-6) and the remaining 20 roads (6 County roads) would be crossed "at-grade". Sixteen "at-grade" light-use (2-track) vehicle crossings, including 7 "at-grade" fence/cattle guard crossings, would be constructed on private lands along the rail spur right-of-way. In addition, twenty-two 5-foot by 8-foot, livestock "underpasses" would be developed (see Figure A-7).

The proposed design includes 2 relocations of Majerus Road: about 2,250 feet in Section 2 T. 5 N., R. 26 E., and 500 feet in Section 29 T. 6 N., R. 26 E. 4,100 feet of Old Divide Road in sections 15, 16, and 22 T. 6 N., R. 26 E. would be relocated. About 11,250 feet of 2-track road would be relocated for private "at-grade" crossings. Two existing, underground, gas pipelines would be encased and about 750 feet of ephemeral drainage would be relocated. The majority of road and drainage relocations (about 10 acres) would be accommodated within the rail spur right-of-way (Table I-1). New road construction would cause the abandonment of about 5 acres of old County road.

A 6,800-foot siding would be constructed at the junction of the rail spur and mainline to accommodate a full-length unit train of 115 rail cars, 5 engines, and a caboose. The siding length would allow a coal train to clear the highway as quickly as possible regardless of train traffic conditions on the mainline track. The average train traveling to or from the coal mine should require less than 10 minutes to cross Montana Route 3. A 7,200-

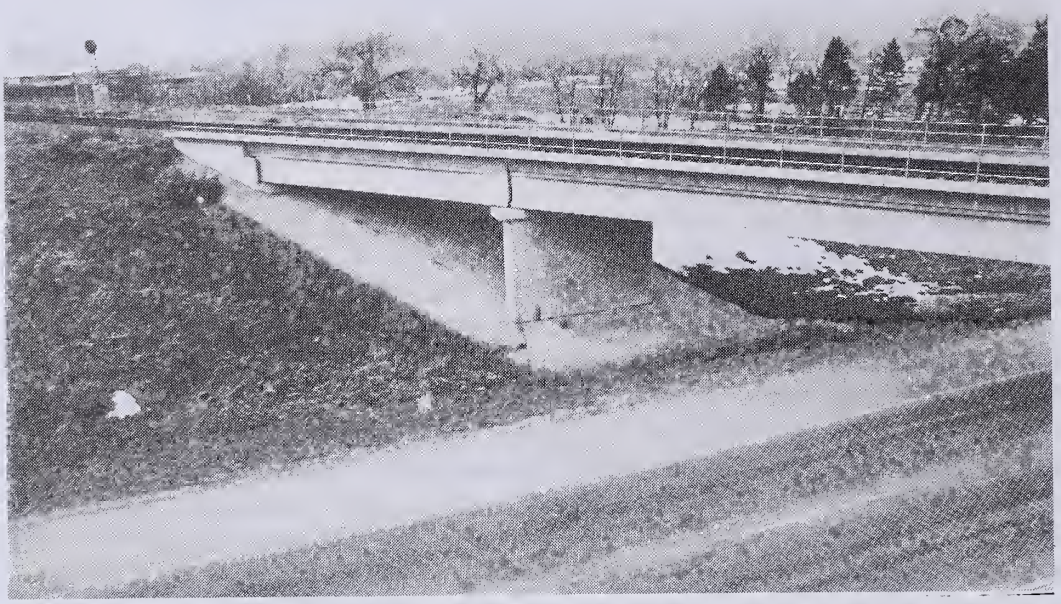


Figure A-4 Typical above-grade highway/ rail crossing

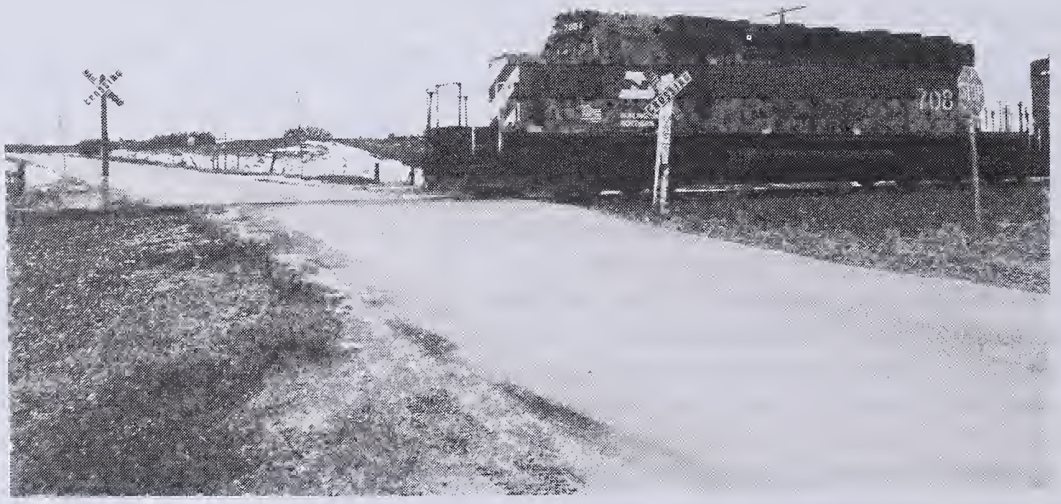


Figure A-5 Typical at-grade highway/ rail crossing

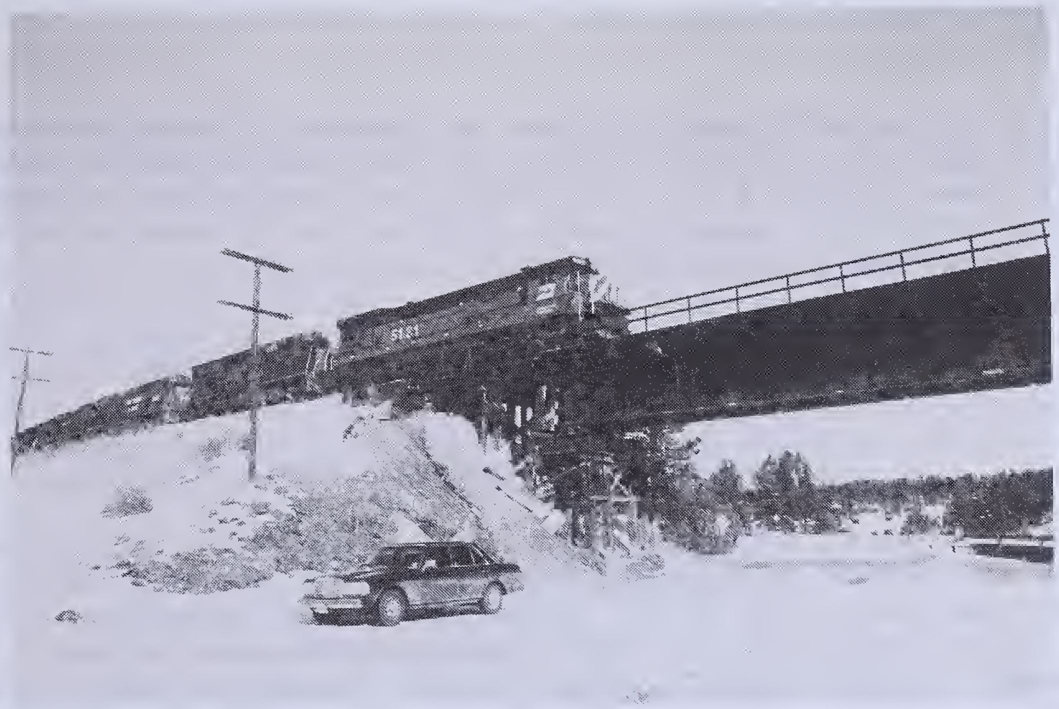


Figure A-6 Typical above-grade county road/ rail crossing

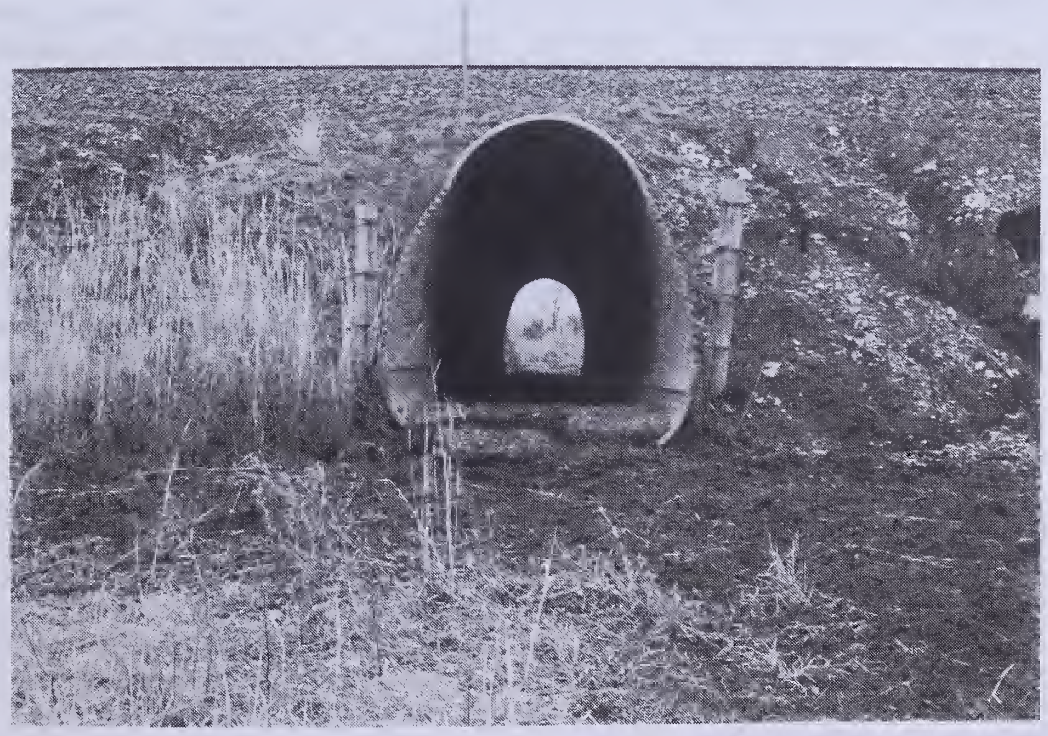


Figure A-7 Livestock underpass

foot rail loop, also designed to accommodate a full-length unit train, would be constructed within the main facilities area at the coal mine (see Figure A-1). In addition, 6,900 feet of dual track would be constructed immediately outside the life-of-mine area for the rail loop/train loadout facility.

E. FACILITY CONSTRUCTION AND MINING

1. Facility Construction

Development of temporary (Phase 1) production facilities would occur on 101 acres previously disturbed by operations at the PM Mine and the coal test pit. Development of permanent (Phase 2) support facilities, hydrologic mitigation activities, wetland enhancement activities, the rail spur, the powerline upgrade/extension, and other mining-related construction would generally involve new surface disturbance.

a. Clearing and grubbing

Before starting topsoil salvage in newly disturbed areas, surfaces would be cleared and very large shrubs or trees that would interfere with topsoil stripping would be removed to an approved disposal site.

b. Topsoil and excess spoil operations

Suitable topsoil and subsoils would be removed from disturbance areas prior to beginning construction activities. Prior to actual topsoil removal operations, proper salvaging depth would be identified and staked under the supervision of a qualified person.

Soil material salvaged at the surface facility complex, about 1.4 million cubic yards, would be stored at one of the 12 nearby stockpiles. About 500,000 cubic yards of excess spoil material, excavated during initial portal development, would be stored in a designated stockpile located near the portal area (see Figure A-1). The spoil stockpile and the majority of topsoil/subsoil stockpiles associated with the surface facility complex would remain in place for the 33-year life of the support facilities. The topsoil/subsoil stockpiles are expected to occupy 45 of 871 acres of the surface facility complex. The spoil stockpile is expected to occupy 23 of the 871 acres.

Soil material salvaged from the rail spur right-of-way (about 1 million cubic yards), and other limited disturbance areas including the hydrologic mitigation and wetland enhancement sites, would be temporarily stored in numerous small stockpiles close to sites from which it was removed. Soils would not be salvaged along the powerline easement.

About 2,000 cubic yards of salvaged soils from construction of the sediment pond at the Huntley loadout were stockpiled in the southwest corner of the facility in 1989. This stockpile is anticipated to remain in place for the entire 2- to 3-year period of Phase 1 truck haul activities. The stockpile occupies 0.2 of the 6.1 acres for the loadout. (Specific details of the existing Huntley loadout facility are included in Appendix B.)

2. Coal Removal

Coal would be removed using both room-and-pillar and longwall methods. Room-and-pillar mining is generally defined as "a system of mining in which part of the coal is left in place as pillars for support", and longwall, "a system of mining whereby most of the coal is mined and the roof over the worked out area is allowed to cave" (Stout 1980). (A complete discussion of room-and-pillar and longwall mining methods is included in Appendix C.) Longwall methods would be used where possible within the mine. Room-and-pillar methods would be used to rework the portals, to develop the main entry and longwall panels, and to mine those irregularly-shaped areas too small to be practical for longwall mining. (See Figure A-8 for a map of longwall/room-and-pillar areas within the mine.)

a. Coal operations during limited production

Phase 1 mine development and limited coal production would begin after completion of the temporary (Phase 1) production facilities and continue through the 2- to 3-year period of permanent (Phase 2) support facility construction.

Existing portals into the coal seam at the PM Mine would be used as 4 primary entries for the proposed mine. New portal work would include the installation of additional protective tunnel liners and the addition/upgrade of bulkheads to protect and stabilize portal areas. Once the 4 primary entries had progressed 1,500 feet into the mine, they would be expanded into 7 mainline entries, using a single continuous miner. Three of these entries would provide travelways for workers, materials, and ventilation intake. Another 3 entries would be used only for ventilation return. An isolated belt entry located between the intakes and returns would be used to transport mined coal to the ROM stockpile outside the main portal.

Development of mainline entries would be followed by development of a room-and-pillar panel in the northern half of

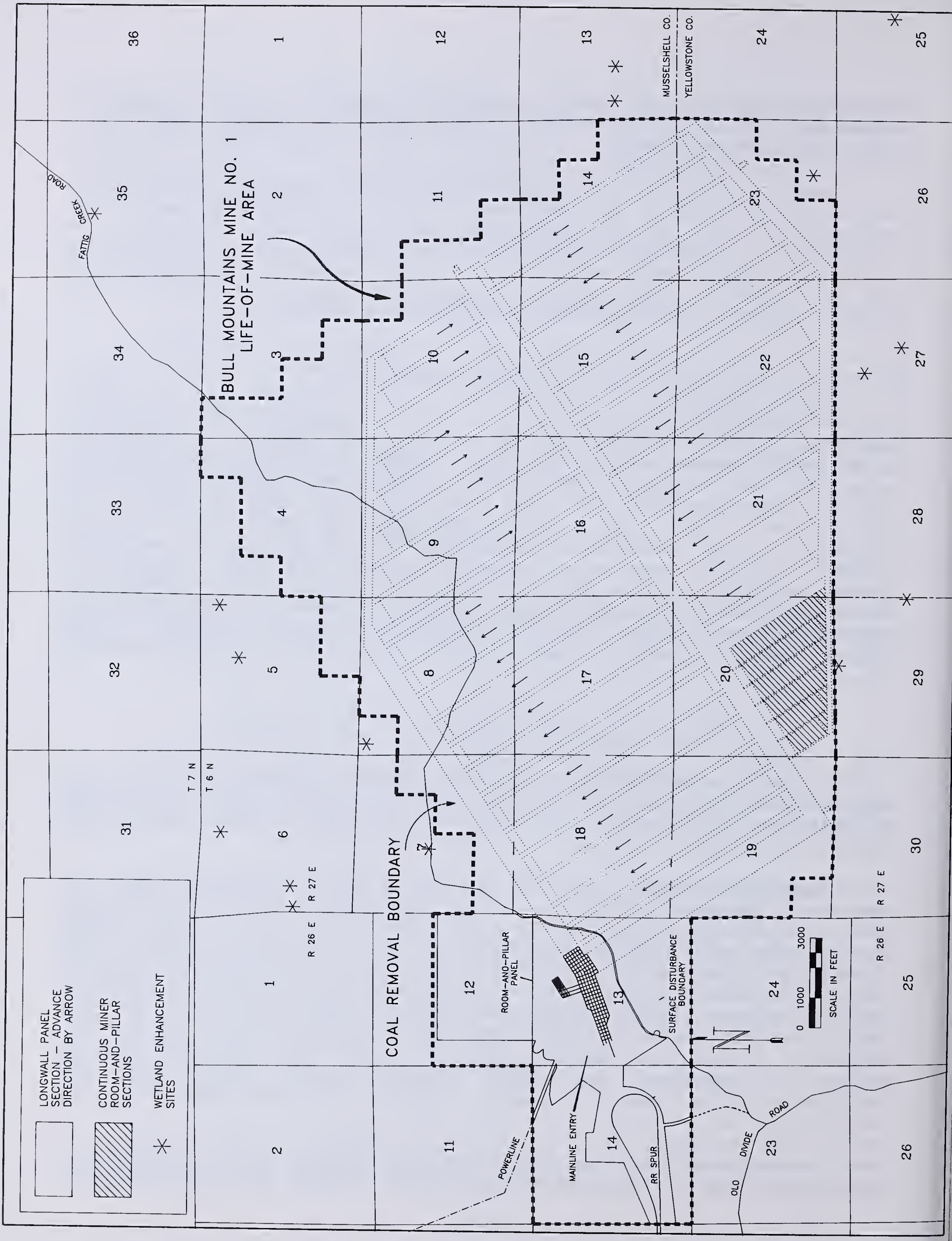

BULL MOUNTAINS MINE NO. 1
LIFE-OF-MINE AREA
COAL REMOVAL BOUNDARY
SURFACE DISTURBANCE BOUNDARY
ROOM-AND-PILLAR PANEL
MAINLINE ENTRY
RR SPUR
POWERLINE
OLD DIVIDE ROAD
FATTIG CREEK ROAD
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
N
0
1000
3000
SCALE IN FEET
LONGWALL PANEL SECTION - ADVANCE DIRECTION BY ARROW
CONTINUOUS MINER ROOM-AND-PILLAR SECTIONS
WETLAND ENHANCEMENT SITES
36
1
12
13
24
25
35
2
11
14
23
26
34
3
10
15
22
27
33
4
9
16
21
28
32
5
8
17
20
29
31
6
7
18
19
30
1
12
13
24
25
2
11
14
23
26

Figure A-8 Life-of-mine area, underground workings, room-and-pillar, and longwall areas

Section 13 (see Figure A-8) to serve as a test area for equipment performance. It would also provide verification of expected geotechnical responses to mining operations, provide experience in panel development techniques, and increase the operator's knowledge of how support pillars would behave.

When development of longwall panel entries began (about 6 months later), a second continuous miner would be added. The first longwall panel would begin in the southeast portion of Section 19 (see Figure A-8). Longwall mining equipment would be installed in preparation for full production mining about 12 months after work on the panel entries began.

During the first 2 to 3 years of limited production, ROM coal removal would increase from an initial rate of 0.62 million tons per year (0.50 million tons of clean coal), to a maximum rate of 1.36 million tons per year (1.10 million tons of clean coal). With a 24-hour workday and 340 workdays per year, maximum production during phase 1 would require about 167 tons of ROM coal to be mined each hour (4,000 tons per day).

b. Coal operations during full production

Full-scale coal production would begin after installation of longwall mining equipment and completion of permanent (Phase 2) support facilities, including the Fergus Electric powerline upgrade/extension and the 33-mile rail spur.

Mining activity would progress from one longwall panel to the next, in a northeasterly direction until reaching the edge of the life-of-mine area. Mining would then shift to the south and progress from one longwall panel to the next (see Figure A-8) in a southwesterly direction until the entire life-of-mine area was mined. It is anticipated that panels 2 to 20 would be mined in years 3 to 21 and panels 21 to 35 would be mined in years 21 to 33 (see Figure A-9).

Proposed longwall panel design requires 3 entries per panel to allow for intake air and access, conveyor belts (coal haulage), and air return. Two 60- to 80-foot pillars would be retained between the 3 entries with cross-cuts about every 120 feet for access. Panel size would range from 550 feet to 820 feet wide and from 4,000 to 8,000 feet long. Longwall equipment would remove the full coal seam up to either 12 or 14 feet.

Six additional room-and-pillar panels would be developed over mine life to maximize recovery of the coal reserve in those portions of the mine too small to accommodate longwall mining techniques (i.e., in the southwest portion of the life-of-mine area). The continuous miner would remove the full coal seam up to 12 feet.

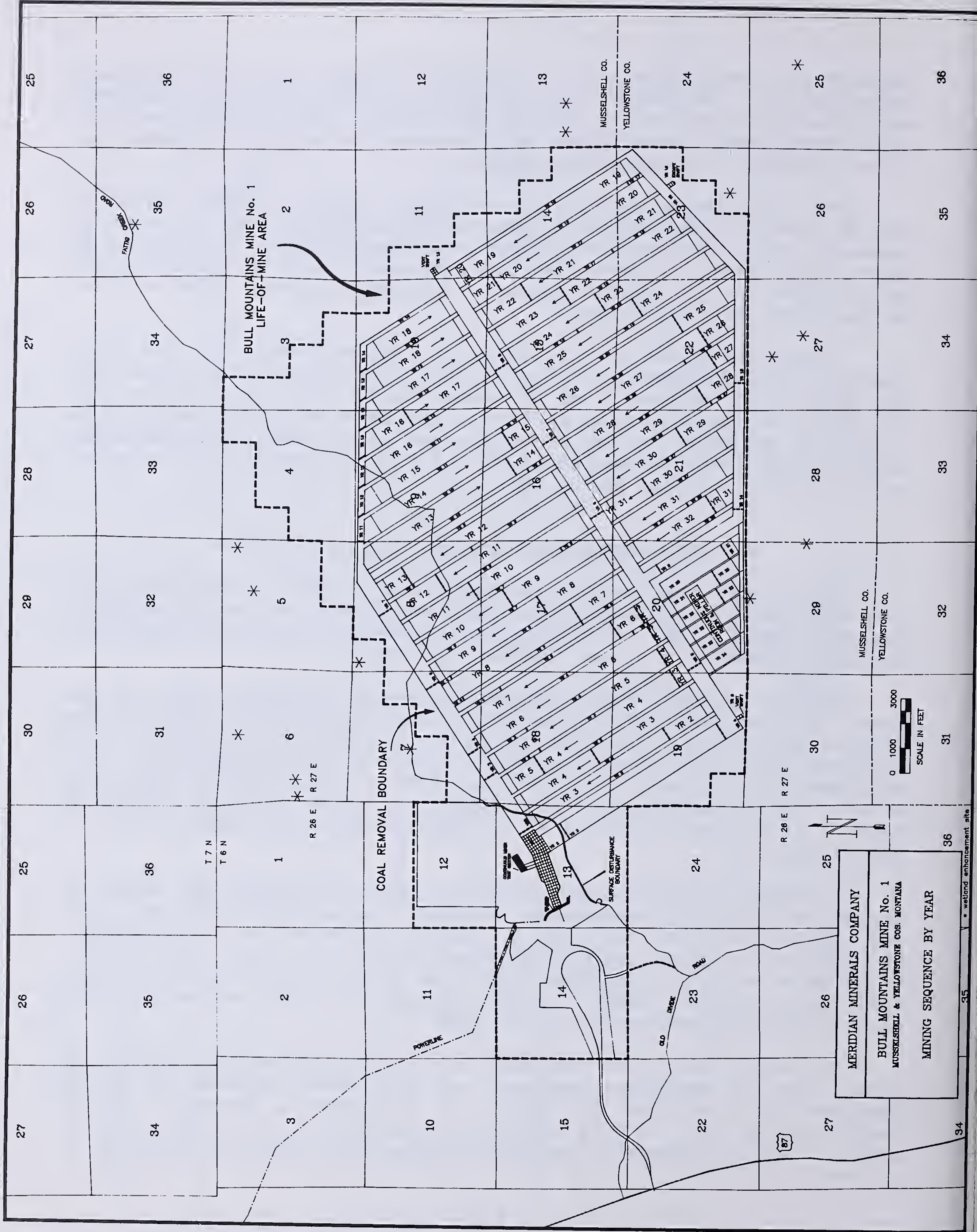

MERIDIAN MINERALS COMPANY
BULL MOUNTAINS MINE No. 1
MUSSELSHELL & YELLOWSTONE COS. MONTANA
MINING SEQUENCE BY YEAR
BULL MOUNTAINS MINE No. 1
LIFE-OF-MINE AREA
COAL REMOVAL BOUNDARY
SURFACE DISTURBANCE BOUNDARY
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
0 1000 3000
SCALE IN FEET
POWERLINE
OLD DIVIDE ROAD
FATTIG CREEK ROAD
87
* wetland enhancement site

Figure A-9 Mining sequence by year

The transfer of coal from mining sections (both room-and-pillar and longwall) to the ROM coal stockpile outside the main portal would be accomplished by using multiple conveyor belt installations that would form a network extending throughout the mine.

During the 30 years of full coal production, ROM coal removal would increase from the initial rate of 1.36 million tons per year (1.18 million tons of clean coal), to a maximum rate of 3.79 million tons per year (3.30 million tons of clean coal). (NOTE: the increased efficiency of Phase 2 coal preparation facilities compared to the Phase 1 facilities would increase the amount of clean coal per ton of ROM coal.) With a 24-hour workday and 340 workdays per year, maximum production during full-scale operations would require about 465 tons of ROM coal to be mined each hour (11,156 tons per day).

3. Coal Transportation

a. Temporary truck haul to the Huntley loadout

During Phase 1 mining activities (the 2- to 3-year period of permanent facility and rail spur construction) coal would be hauled 41.1 miles over County and State roads to the upgraded Montana Rail Link loadout facility near Huntley.

Haul trucks would travel along Fattig Creek Road from the mine and then down Old Divide Road to its southern intersection with U.S. 87 (see Figure I-2). They would follow U.S. Highway 87 south to Highway 312, then east to Huntley. In Huntley, trucks would proceed south along Heath Street to the loadout site (see Figure A-3).

Loadout capacity at the upgraded Huntley facility (750 tons per hour) would allow one 115-car unit train to be loaded in 16 hours. With an average capacity of 11,500 tons of coal per train (100 tons per car), maximum production would require 95 unit trains to be loaded each year (1 train every 3 to 4 days).

Twelve highway-rated trucks with tandem trailers would operate 24 hours per day, 340 days per year. With an average capacity of 37.8 tons of coal per truck, maximum production would require 29,100 loads to be trucked to the Huntley loadout each year. The 82-mile round trip to the loadout is expected to take at least 2.2 hours to complete, requiring each truck to make 7 to 8 trips each day (1 truck every 15 to 17 minutes). Coal-related traffic along Heath Street in Huntley would be restricted to a maximum speed of 15 MPH, all truckloads would be protected from wind using tarps and/or special trailer designs, and, to minimize noise, the use of "jake" brakes would be prohibited. Pending formal regulatory approval by the U.S. Mine Safety and Health Administration (MHSA), the bulldozer and loader used in coal-handling operations would be equipped with strobe warning systems, replacing the standard backup alarm, to minimize noise during night operations. Night-hauling operations could be increased for short periods of time during heavy traffic periods (i.e., during beet harvesting) to reduce the overall levels of daytime traffic.

b. Full production train delivery of coal

During Phase 2, after permanent processing and rail spur facilities had been constructed, coal from the proposed mine would be loaded directly into trains at the main facilities area. Activities at the coal loadout in Huntley would be phased out and the facility closed.

The unit train loadout station would consist of a 300 ton surge bin with an automatic weighing system for accurately loading rail cars. Coal would discharge into the surge bin from the clean coal stockpile conveyor and pass through gates to a 100-ton weigh bin. The weigh bin would discharge through a loading chute directly to the rail cars.

The loadout capacity at the rail loop facility would allow one 115-car, unit train to be loaded in 2 to 3 hours (500 tons per hour). With an average capacity of 11,500 tons of coal per train (100 tons per car), maximum production would require 287 unit trains to be loaded each year (1 train every 1 to 2 days).

c. Local market truck/package delivery of coal

Throughout the 33 years of coal production, coal would continue to be supplied to those local markets currently served by PM Mine. Truck/package coal delivery during Phase 1 of mining activity (the first 2 to 3 years of permanent, Phase 2, facility construction) would use existing PM Mine facilities. Phase 2 package delivery would use a newly-constructed series of 20-ton bins along one side of the coal preparation plant to store various product mixes according to demand. Clean coal would be transferred to the appropriate bin by an in-plant conveyor system and customer haul trucks would drive under the bin for loading. A weigh scale would record the truck's weight both before and after loading for billing purposes.

F. RECLAMATION PLAN

Development, mining, and reclamation plans are interdependent to assure that reclamation for each component of the Project might be performed at the earliest possible time. Reclamation activities fall into one of 2 categories: interim (temporary) and final (permanent). Interim activities are those intended to stabilize an area during its short-term use in the mining operation, while final activities are those intended to return the area to its long-term condition before releasing a company's responsibility.

Interim reclamation activities would occur primarily during the first 3 years of the mine, after premining development was complete. They would occur on a smaller scale throughout the remainder of the mine life, as other components of the Project came into play. Final reclamation activities would begin immediately after the need for a particular Project component was over. In the case of the powerline upgrade/extension and other temporary disturbance activities (e.g., exploratory drilling activities, hydrologic mitigation activities, wetland enhancement), final reclamation would occur immediately after construction activities were complete. This would occur in year 1 of the mine for the powerline upgrade/extension. Final reclamation would occur in year 3 or 4 of the Project for the Huntley loadout, the rail spur right-of-way outside the roadbed and adjoining fire guards, and those portions of the PM Mine operation not being used for Phase 2 coal production. Final reclamation at the WDA would occur in stages, as portions of the area reached final grade (possibly as early as year 9 of the mine). Final reclamation of all remaining mining-related disturbances (i.e., the main facilities, the WDA, the mine portals, the rail spur right-of-way) would not begin until the end of underground mining activities in year 33 of the mine.

Interim/final reclamation and bond release would proceed as follows:

Year 0 - End of the useful service life for a particular Project component, or portion thereof.

Year 1 - Backfilling; regrading; topsoil replacement; recontouring; drainage control; revegetation; and bond release, when appropriate (up to 60 percent of original bond amount for that component).

Year 3 - Vegetation established; and bond release, when appropriate (that portion of the original bond amount for topsoil replacement).

Year 11+ - Vegetation sampling; and bond release, when appropriate (remaining bond amounts for that component, if reclamation was successful and bond release requirements were fully met).

1. Postmining Land Use

Primary historical land uses for the Bull Mountains area, including the area of the proposed rail spur, have been cattle production and year-round wildlife habitat. Other land uses have been hay production, timber production, coal mining, and recreation. Reclamation efforts throughout the life-of-mine area, and on outlying wetland enhancement areas, would return most postmining surface uses to livestock grazing and wildlife habitat.

Some ranching operations would be eliminated during the period of active mining operations. This would occur within the surface facility complex (including the WDA), along the rail spur right-of-way, and in other small areas designated for hydrologic mitigation, wetland enhancement, or other revegetation mitigation. Ranching operations along the powerline easement would be temporarily disrupted during the actual upgrade and extension activities. Other ranching operations within the life-of-mine area should continue uninterrupted. Revegetated areas that were judged to be capable of withstanding grazing pressures would again be incorporated into ranching activities.

Other than a small acreage of improved pastureland associated with past reclamation at the PM Mine, and a small area in the proposed WDA, there are no improved rangelands, croplands, or pasturelands within the proposed life-of-mine area. Neither are any proposed for postmining land use. Croplands and pasturelands disturbed along the rail spur right-of-way would not be replaced since the spur would be reclaimed in place after the end of mine service.

Industrial development has been the historical land use at the Huntley loadout. Use would continue according to the long-term plans of Montana Rail Link after proposed coal loadout operations had been completed.

2. Postmining Topography

Premining elevations in the proposed life-of-mine area range from 3,790 to 4,710 feet above mean sea level. Premining elevations in the WDA range from 3,850 to 4,050 feet, while elevations in the rock quarry range from 3,990 to 4,050 feet. Premining elevations in the main facilities area, including the existing PM Mine, range from 3,800 to 3,970 feet.

Postmining elevations in the WDA (including the rock quarry) are expected to rise from 0 to 130 feet -- to a maximum 4,050 feet above sea level. This reflects the net raising of the landscape resulting from "head of hollow" filling that would take place. All regraded areas in the WDA would be constructed with maximum slopes of 3 horizontal to 1 vertical (3h:1v), except for the bench faces which would be constructed with maximum 5h:1v slopes. New drainage patterns, channels, and floodplains in the WDA would be constructed with sufficient capacity to carry flow from a 100-year, 24-hour precipitation event at nonerodible velocities. Additional channel stability would be achieved through a high degree of compaction and revegetation. Figure A-10 shows premining topography and slopes of the WDA. Figure A-11 shows postmining topography, slopes, and vegetation after backfilling and regrading.

Postmining elevations in the main facilities area would be expected to approximate original elevations and contours except in the area of the existing PM Mine. Elevations in the area of the old surface mine pit would rise about 60 feet from backfilling and regrading. Drainage channels and floodplains would be re-established throughout the area with sufficient capacity to carry flow from a 100-year, 24-hour precipitation event at nonerodible velocities. Postmining contours in this area would also blend with adjacent premining topography as much as possible.

Elevations in coal removal and buffer areas of the life-of-mine area would essentially remain unchanged, although local surface impacts from mining-related subsidence are expected in the coal removal area. Postmining contours in those areas where limited surface disturbance is proposed (i.e., for access roads, ventilation shafts, exploration drill holes, hydrologic mitigation, and wetland enhancement) would approximate original contours at or near original elevations. Drainage channels and floodplains would be re-established throughout each disturbance area with capacity to carry flow from a 100-year, 24-hour precipitation event at nonerodible velocities.

Postmining topography on private land along the rail spur right-of-way would be changed permanently since the roadbed would be abandoned in place after the removal of the rail, ties, and road ballast. State parcels would be regraded to approximate original contours and completely revegetated to Montana DSL standards.

All newly-constructed roads, including the WDA haul road and the various light use/temporary roads, would be reclaimed and road surface materials salvaged. Fill portions would be regraded into cut areas, subsoil and topsoil would be replaced, and the disturbed areas reseeded. Existing roads/trails would be restored to original condition and reseeded at the end of their use.

All exploration holes, wells, ventilation shafts, and other exposed underground openings would be permanently sealed or plugged when no longer needed for mine operation. Any mine entry that was temporarily inactive but had future useful life would be protected by barricades or other covering devices, fenced, and posted with signs to prevent access and to identify the hazard.

Facilities for hydrologic mitigation and wetland enhancement programs would be left intact and operational. Final disposal of

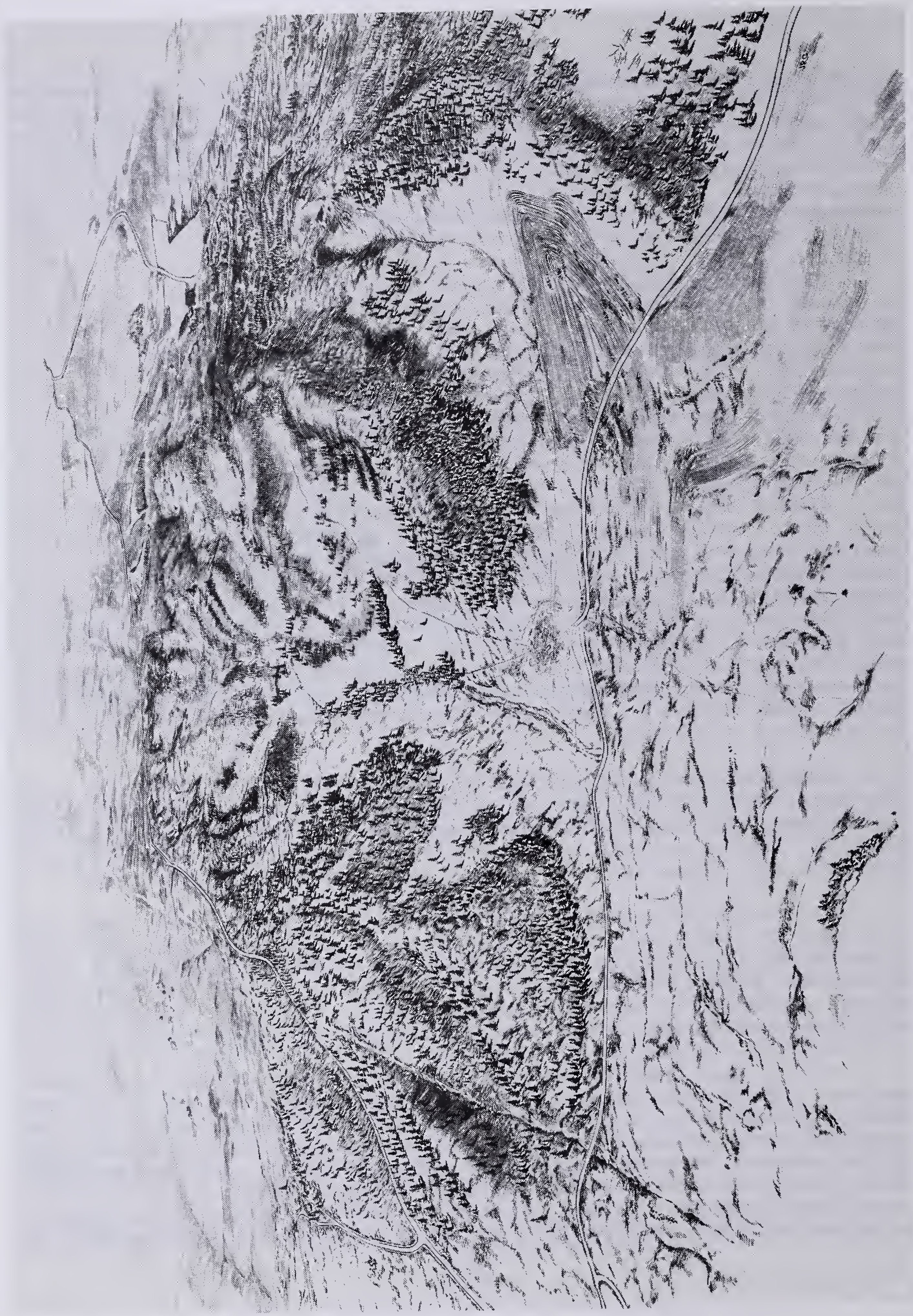


Figure A-10 An isometric view of premining topography in the waste disposal area

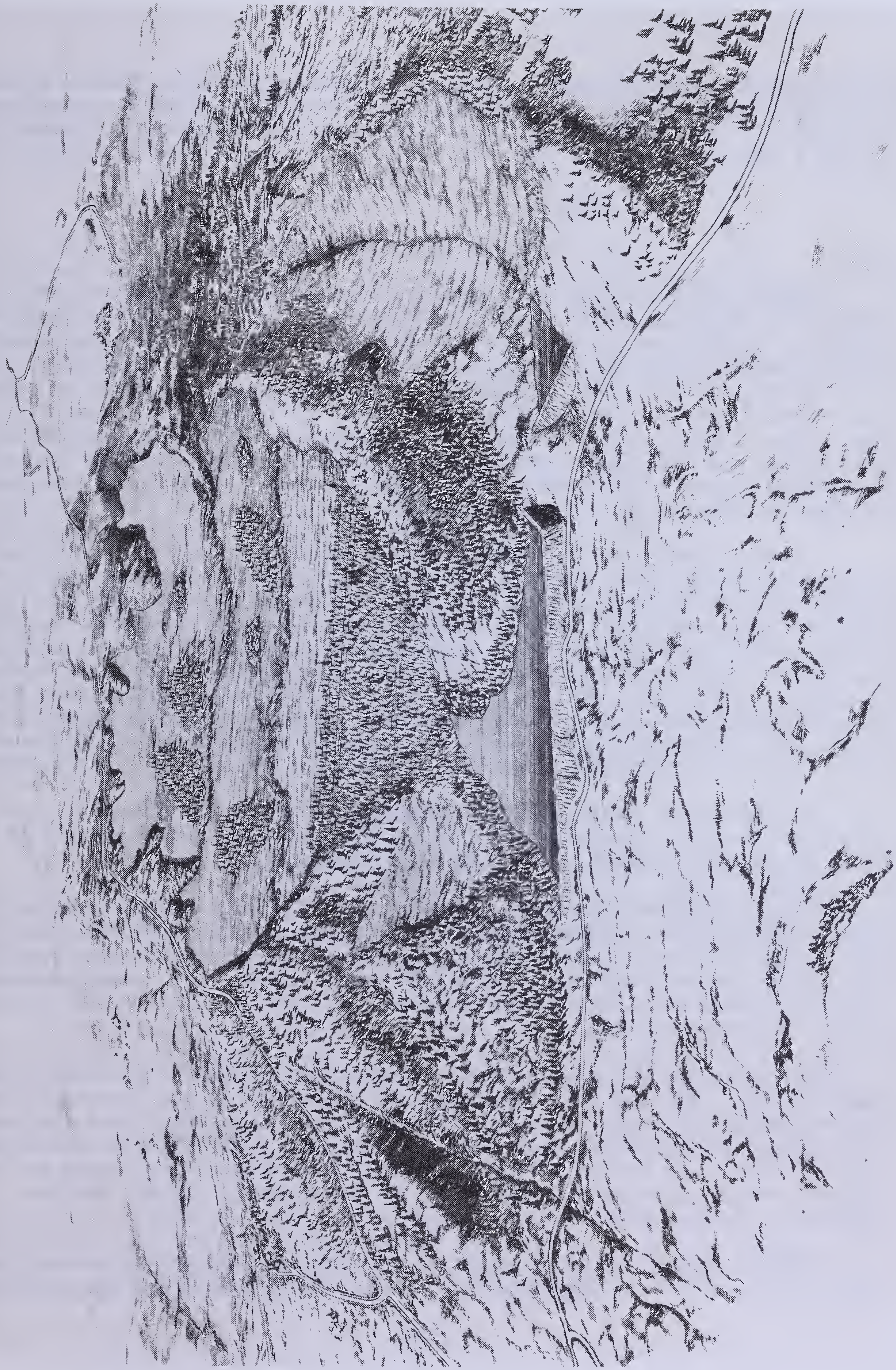


Figure A-11 An isometric view of postmining topography in the waste disposal area those portions of the rail spur right-of-way outside the life-of-mine area and not on State-owned land would involve removal and salvage of the ties, rail, and ballast. Fill material used to prepare the base grade for the rail spur would be abandoned in place.

3. Backfilling and Grading

Rough backfilling and grading would be completed on all disturbed areas within the life-of-mine area and at the Huntley loadout, as soon as possible after they were determined unnecessary for mining-related activities. During the period of active mining operations, backfilling and grading would be required only in those disturbed lands at the PM Mine unnecessary for Phase 2 operations, the WDA, or in temporary-use areas. After ending mining operations, backfilling and grading would be required for all disturbed areas within the life-of-mine area not already included in the reclamation program.

Access roads, haul roads, and the rail loop would be regraded by pushing the fill portion of each area into the cut portion. Highwalls throughout the life-of-mine area would be all but eliminated by backfill operations with contours established so that slopes were less than 3h:1v. The highwall portion of the surface facilities area would be eliminated after the portals had been plugged. The majority of the excess spoil pile would be graded into the cut area, against the highwall. Reclamation grading plans would be designed based on a net swell factor of 10 percent, allowing for recompaction during grading by reclamation equipment.

No permanent sedimentation impoundments are proposed to remain after reclamation operations. Sediment and storage ponds would be backfilled and graded upon final reclamation.

Rough grading of those portions of the rail spur outside the life-of-mine area between the fire control barrier and the edge of the right-of-way would occur immediately after construction activities were complete. Limited backfilling and grading would occur on those portions being used as railbed and fire barrier upon final reclamation.

The grading program would be designed to create an undulating topography. Dozers and scrapers would be used to backfill and rough-grade each area to about 1 foot below the postmining contour. The ground would be ripped both before and after the subsoil and topsoil had been redistributed. Ripping would be performed on the contour where possible, and to a minimum depth of 12 inches. A ripper or deep shank plow would be used.

Within the life-of-mine area and at the Huntley loadout, the top 4 feet of overburden/backfilled material would be composed of material suitable for revegetation. In addition, all slopes of reclaimed areas would be constructed compatibly with adjoining undisturbed areas and postmining land use.

4. Backfilling (Special Handling)

Certain unsuitable material in the spoil (e.g., highly carbonaceous units, acid-forming material, coal rider seams) would be selectively handled. This material would be placed below the vegetation rooting zone, above the ground water potentiometric surface, and outside the area of drainage channels or their floodplains. Regraded spoil in the main facilities area would be sampled to a depth of 8 feet (0 to 4 feet and 4 to 8 feet).

Unsuitable mine development and processing waste (e.g., coal fines, rock) would be placed in the WDA. After compacting, it would be covered by a 4-foot layer of topsoil and subsoil material. Regraded soil materials in the WDA would be sampled for unsuitable toxic material to a depth of 4 feet (0 to 4 feet).

To be sure no unsuitable material was overlooked, sampling would occur at a density of 1 hole per 300 feet on a square grid basis. Samples would be analyzed for unsuitable material using a saturated paste extract. Should any sampled materials prove unsuitable for revegetation, additional sampling would locate the exact area of unsuitable material. These areas would be eliminated by either deep ripping and blending, adding supplements, or removing the unsuitable material and replacing it.

5. Topsoil Replacement

Topsoil would be spread uniformly across all disturbed life-of-mine areas to a depth of about 15 inches, after backfilled material had been graded to slightly more that 1 foot below final elevation, and deep ripped on the contour. Topsoil/subsoil stockpiled at the Huntley loadout would be used to backfill the sediment pond.

Along those portions of the rail spur right-of-way outside the life-of-mine area, available topsoil would be respread over graded, unripped slopes between the fire control barrier and the edge of the right-of-way immediately after construction. No topsoil would be replaced on those portions being used as railbed and fire barrier during final reclamation except on State-owned parcels.

After being respread, topsoil would be graded to final contours required to establish the postmining topography. Replacement would be accomplished by scrapers and/or dozers, and grading by rubber-tire graders. To prepare an adequate seedbed, the soil would be tilled after final grading.

6. Revegetation Operations

All lands disturbed within the life-of-mine area, Huntley loadout, and State-owned portions of the rail spur right-of-way would be revegetated. Seven postmine vegetation communities (grassland, shrub, ponderosa pine, mixed grassland-shrub, improved pasture, agriculture, and wetlands) would be re-established, where appropriate, within the life-of-mine area. The mixed grassland-shrub vegetation type would be re-established in the area of the regraded sedimentation pond at the Huntley loadout. The improved pasture and other appropriate vegetation types would be established along the proposed rail spur right-of-way outside the life-of-mine area.

No revegetation activities are proposed along the powerline easement, outside of the life-of-mine area. Final revegetation would rely on the natural invasion of species from nearby undisturbed communities.

All seedings would take place within 90 days of soil replacement if possible. Otherwise they would occur immediately prior to, or during, the most favorable period for plant growth. To take advantage of late fall, winter, and early spring moisture, fall seedings would take place from October 1 to freeze-up. Spring seedings would begin after spring thaw and continue until early May. Both drill seeding and broadcast seeding would be used, depending upon time of year, soil texture, vegetation species, and slope. Rates for drill seeding would range from 15 to 35 pounds of pure live seed per acre, or at least 30 seeds per square foot. Where broadcast seeding was used, seeding rates would double the rates used for drilling. If an area were not ready for revegetation in the early spring or late fall, it would be rough-tilled and mulched. Cover crops of annual grain may be planted at rates of from 10 to 15 pounds per acre in conjunction with seedings of perennials.

Mulch would be used at reclaimed sites, as needed. Straw mulch would be used at a rate of 1.5 tons of clean straw or hay per acre and anchored by a crimper. Artificial mulches, such as hydromulch, rock riprap, jute netting, excelsior, and paper-net mulch, would be used when stubble or straw mulch was not sufficient.

A total of 8 seed mixtures are proposed for use in revegetation activities. The first 7 mixes would provide the basis for the permanent re-establishment of major premining vegetative communities in the life-of-mine area, the Huntley loadout, and State-owned portions of the rail spur. Mixture No. 5 is proposed for the permanent stabilization of non-State-owned portions of the rail spur right-of-way outside the life-of-mine area. Mixture No. 8 is proposed for use in temporary revegetation and stabilization throughout the Project area.

Seed mixture No. 1, the grassland revegetation mixture, would be used to restore the disturbed, premine green needlegrass/western wheatgrass, needle-and-thread grass/western wheatgrass, bluebunch wheatgrass/needle-and-thread grass, and little bluestem/prairie sandreed communities throughout the area. It would consist of: thickspike, western, and slender wheatgrass, blue grama, prairie junegrass, Sandberg bluegrass, needle-and-thread grass, green needlegrass, common yarrow, purple prairie clover, spotted gayfeather, Lewis flax, prairie coneflower, and scarlet globemallow. (Note: Scientific names for all of the proposed revegetation species can be found in Table A-2.)

Seed mixture No. 2, the shrub revegetation mixture would be used to restore the disturbed, premine fragrant sumac/bluebunch wheatgrass, silver sagebrush/green needlegrass, and western snowberry/green needlegrass communities throughout the area. It would consist of: thickspike, western, and slender wheatgrass, blue grama, Sandberg bluegrass, needle-and-thread grass, green needlegrass, common yarrow, Lewis flax, prairie coneflower, scarlet globemallow, silver sagebrush, Wood's rose, and western snowberry.

Seed mixture No. 3, the ponderosa pine revegetation mixture, would primarily be used to restore the disturbed, premine ponderosa pine/bluebunch wheatgrass and ponderosa pine/western snowberry communities throughout the area. It would consist of: thickspike and slender wheatgrass, Indian ricegrass, Sandberg bluegrass, needle-and-thread grass, green needlegrass, common yarrow, Lewis flax, arrowleaf balsamroot, prairie coneflower, scarlet globemallow, Wood's rose, and western snowberry. Ponderosa pine seedlings would be planted in association with this mixture to re-establish the tree component of these communities.

Seed mixture No. 4, the mixed grassland/shrub revegetation mixture, would primarily be used to restore the disturbed, premine burned ponderosa pine community throughout the area. It would consist of: thickspike, western, and bluebunch wheatgrass, little bluestem, prairie sandreed, Indian ricegrass, green needlegrass, needle-and-thread grass, common yarrow, Lewis flax, arrowleaf balsamroot, spotted gayfeather, Wood's rose, and fragrant sumac.

Seed mixture No. 5, the improved pasture revegetation mixture, would be used to restore disturbed, premine tame pastureland community within the life-of-mine area and those portions of the rail spur right-of-way that lie outside the life-of-mine area. It would consist of: crested and intermediate wheatgrass.

Seed mixture No. 6, the agriculture revegetation mixture, would be used to restore disturbed, premine agricultural lands intensively managed for forage crops within the life-of-mine area. It would consist of: alfalfa.

Seed mixture No. 7, the wetland mixture, would be used for the restoration of the wetland communities throughout the area,

TABLE A-2

Revegetation Species
for the
Proposed
Bull Mountains Mine No. 1
and
Associated Facilities

Grasses:	
Agropyron cristatum	crested wheatgrass
Agropyron dasystachym	thickspike wheatgrass
Agropyron intermedium	intermediate wheatgrass
Agropyron smithii	western wheatgrass
Agropyron spicatum	bluebunch wheatgrass
Agropyron trachycaulum	slender wheatgrass
Agrostis stolonifera	red-top grass
Bouteloua gracilis	blue grama
Calamovilfa longifolia	prairie sandreed
Koleria cristata	prairie junegrass
Lolium multiflorum	Italian ryegrass
Oryzopsis hymenoides	Indian ricegrass
Poa sandbergii	Sandberg bluegrass
Andropogon scoparius	little bluestem
Stipa comata	needle-and-thread grass
Stipa viridula	green needlegrass
Grass-like:	
Carex nebraskensis	Nebraska sedge
Carex vulpinoidea	unnamed sedge
Eleocharis palvstris	spikerush
Scirpus volidus	soft-stem bulrush
Typha latifolia	broad-leaved cattail
Forbs:	
Achillea millefolium	common yarrow
Balsamorhize sagittata	arrowleaf balsamroot
Dalea purpurea	purple prairie clover
Liatrus punctata	spotted gayfeather
Linum lewisii	Lewis flax
Medicago sativa	alfalfa
Ratibida columnaris	prairie coneflower
Sphaeralcea coccinea	scarlet globemallow
Shrubs:	
Artemisia cana	silver sagebrush
Rhus trilobata	fragrant sumac
Rosa woodsii	Wood's rose
Symphoricarpos occidentalis	western snowberry
Trees:	
Pinus ponderosa	ponderosa pine

particularly the hydrologic mitigation and wetland enhancement sites. It would consist of: red-top grass, Nebraska sedge, an unnamed sedge, fowl mannagrass, spikerush, softstem bulrush and broadleaf cattail.

Seed mixture No. 8, the interim revegetation mixture, is made up of rapidly-establishing, drought-tolerant grasses. It would be used as a temporary cover for stabilization purposes around facilities, on settling ponds, and on topsoil/spoil stockpiles with a life of more than 6 months. This mix would consist of: thickspike, western, and slender wheatgrass, and Italian ryegrass.

Natural invasion and/or seeding would be used to re-establish the shrub components of the premine communities within the life-of-mine area. Ponderosa pine seedlings would be planted in pockets to re-establish the tree component of the disturbed, premine ponderosa pine/bluebunch wheatgrass and ponderosa pine/western snowberry communities, including the north face and top of the WDA. Natural invasion would be used to re-establish the shrub/tree components of those communities disturbed by linear facility development (e.g., rail spur construction, County road abandonment, powerline upgrade/extension) outside the life-of-mine area.

7. Revegetation Enhancement

Fertilization would occur during seeding operations, as needed. Before reseeding, routine representative soil samples would be taken to determine fertilization rates.

Where possible, broadcast-seeded areas would be chained, harrowed, multi-packed, or dozer-tracked to firm the seedbed and cover seed.

Weeds and pests would be controlled whenever they became a major problem. Herbicides could be used, but mowing of weeds before seed maturity would be the preferred control method.

Snow fences would be temporarily installed on sites tending to be dry or subject to wind erosion (i.e, tops of hills and windward slopes) and on sites where species diversity and seedling establishment could be aided by the concentration of winter moisture.

Final grading would include occasional use of small depressions to minimize erosion, trap sediment, conserve moisture and promote vegetation. These depressions would be field located during reclamation activities and would not restrict normal access through the reclaimed areas or constitute a hazard.

To the extent possible, soil materials would not be handled under unduly moist or wet conditions in order to avoid compaction.

Similarly, soil handling would be avoided during extremely dry conditions to reduce the potential for excessive erosion. Topsoil would be hauled directly from the stripping area to the final revegetation site, when possible.

Contour furrows would be employed along the highwall reclamation area, and installed prior to seeding.

Alternative erosion control techniques would include use of barriers, check dams, erosion stops, matting and roughened surfaces. These treatments can be implemented with various kinds of straw bales, netting, and matting to effectively reduce overland flow. If gullies deeper than 9 inches should form, the gullies would be blocked with one of the above-mentioned treatments and given the opportunity to stabilize naturally, by vegetation growth.

Temporary fences would ensure protection from trampling and grazing by cattle for all areas that had been revegetated, until the plant communities were mature enough to withstand grazing pressure. Grazing would occur at least 2 years during the last 5 years of responsibility for vegetative establishment. Permanent postmining fences would be built to achieve the goals of future land management systems.

8. Hydrologic Mitigation

Water resources at 42 of the 130 existing springs and seeps in the Bull Mountains area could be disrupted by mining-related subsidence (Table III-3). Impacts to these resources would be mitigated through the use of interim water supplies, repair of shallow surface fractures, horizontal drains, vertical wells, guzzlers (see Guzzlers, below), ponds (reservoirs), and/or supplementation using water distribution systems (see Table A-3).

Mitigation plans at these springs would follow a multi-step process, initiated in separate phases throughout mine life: 1) an interim water supply would be established; 2) shallow surface fractures affecting the existing hydrologic feature would be repaired, when appropriate; and, if necessary, 3) a permanent - replacement or supplemental water source would be developed. Horizontal drains would be installed at most springs, but vertical wells, ponds, or water distribution systems would be used as needed.

The 88 remaining springs or seeps that are not believed to be at substantial risk would be monitored for mining-related effects (see Hydrologic Monitoring and Table A-3). If monitoring indicated that any of those springs were impacted by mining-related activities, an appropriate mitigation method would be implemented in consultation with Montana Department of State Lands (DSL).

TABLE A-3
Bull Mountains Mine No. 1
Hydrologic Mitigation Plan

Station	Surface Fracture Repair	Pond Repair	Pond Enlarge	Pond New	Horizontal Drain	Shallow Well	Deep Well	Guzzler	Distribution System	Comments
14115					X					
14155					X					
14165				X					X	From Spring 14155
14255	X	X							X	From Spring 14115
14325	X	X							X	From Spring 14115
14415	X		X							
14535	X	X							X	From Spring 14115
14555	X				X					
16135					X					
16145					X					
16165					X					
16255	X								X	From Spring 16135
16275	X	X			X					
16355	X								X	From Spring 16135
16365	X			X					X	From Spring 16135
16625	X				X					
16655	X	X							X	From Spring 16135
16755	X							X		
16855	X							X		
16955	X			X						
17415	X	X					X			
17515	X	X							X	From Spring 17415

TABLE A-3 (Continued)
Bull Mountains Mine No. 1
Hydrologic Mitigation Plan

Station	Surface Fracture Repair	Pond Repair	Pond Enlarge	Pond New	Horizontal Drain	Shallow Well	Deep Well	Guzzler	Distribution System	Comments
17635		X			X					
17655	X	X					X			
17685	X	X							X	From Spring 17655
52125	X	X			X					
52145	X	X			X					
52225	X	X			X					
52235	X				X					
52255	X				X					
53115	X					X				
53125	X					X				
53145	X				X					
53155	X				X					
53175	X	X							X	From Spring 53115
53225	X				X					
53245	X				X					
53525	X				X					
53535	X	X			X					
53545	X			X						
71115	X				X					
71125					X					
Maximum Cumulative										
Numbers	34	15	1	4	22	2	2	2	11	
Acres	3.4	15.0	1.0	4.0	2.2	2.0	6.0	4.0	15.0	52.6 Acres

Wells, springs, ponds, and distribution systems would require maintenance, repair, and replacement, to varying degrees. These would be provided for by creation of a permanent trust funded by Meridian and guaranteed by the reclamation bond. The trust principal would be deposited in an account in the State non-expendable trust fund. The principal of the trust would be established in an amount projected to ensure that maintenance, repair, replacement, and operating costs could be paid from trust income. In addition, a portion of the income would be dedicated to the principal in an amount projected to be sufficient to maintain the real value of the principal. The trust would be administered by Montana DSL or any successor agency.

a. Interim water supply

Livestock and wildlife drinking water would be replaced on an interim basis when a negative change in water quantity affecting the hydrologic function was detected at a spring, wetland, and/or pond as a result of mining-related activities. Water would be hauled by truck to temporary or existing stock tanks as needed to insure uninterrupted water supplies. Depending on the land use of the impacted area, some other rapid response approach may be implemented, as approved by Montana DSL. To minimize disturbance, temporary stock tanks would be located near the disrupted water source.

b. Fracture repairs

When negative changes in water quantity were associated with shallow, surface-subsidence fractures or cracks, the damage would be repaired, as appropriate. Depending on the type of spring or seep involved, low-permeability fill material, synthetic pond liners, porous gravel filter material, perforated pipe, or native material would be installed. About 0.1 acre would be disturbed during the fracture repair operation at each spring. Since fracture repair could occur at 34 springs/seeps, the maximum cumulative disturbance associated with fracture repair would be 3.4 acres.

c. Horizontal drains

New horizontal drains would be used to mitigate impacts at 22 springs and seeps (see Table A-3 and Figure A-12). Targeted springs are those located in the higher portions of the drainage basins where horizontal drains could tap the shallow fractured and weathered bedrock zone. They would range in length from about 50 to 250 feet and would be constructed with 2-inch, PVC pipe or other suitable material. About 0.1 acre would be disturbed during the installation of each drain. The maximum cumulative disturbance associated with drain development would be about 2.2 acres. Water storage and delivery systems would be built with each drain. Cut-

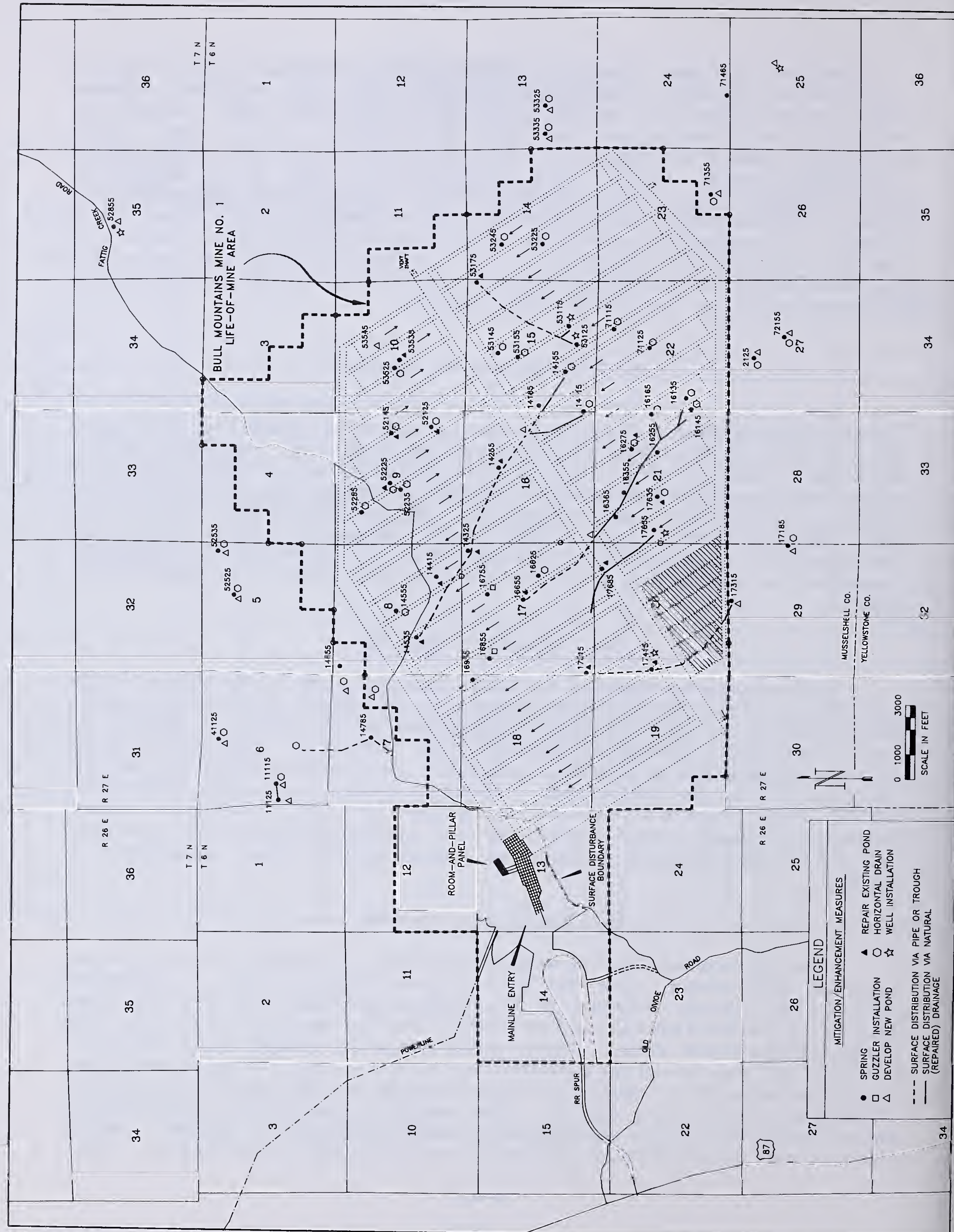

BULL MOUNTAINS MINE NO. 1 LIFE-OF-MINE AREA
ROOM-AND-PILLAR PANEL
SURFACE DISTURBANCE BOUNDARY
MAINLINE ENTRY
VENT SHAFT
RR SPUR
OLD ROAD
ROAD
POWERLINE
FATTIG CREEK
MUSSELSHELL CO.
YELLOWSTONE CO.
T 7 N
T 6 N
R 26 E
R 27 E
87
0 1000 3000
SCALE IN FEET
N
LEGEND
MITIGATION/ENHANCEMENT MEASURES
● SPRING
□ GUZZLER INSTALLATION
△ DEVELOP NEW POND
▲ REPAIR EXISTING POND
○ HORIZONTAL DRAIN
☆ WELL INSTALLATION
- - - SURFACE DISTRIBUTION VIA PIPE OR TROUGH
—— SURFACE DISTRIBUTION VIA NATURAL (REPAIRED) DRAINAGE

Figure A-12 Hydrologic mitigation and wetlands enhancement program and-fill material for drain development would be equally balanced to eliminate excess material. The disturbed area would be immediately revegetated and enclosed with barbed-wire fencing to limit public/livestock access.

d. Wells

New vertical wells would be used to mitigate impacts at 4 springs and seeps (see Table A-3 and Figure A-12). Two shallow wells, ranging from 50 to 100 feet, would tap the shallow fractured and weathered bedrock in those areas where access or topography preclude the use of horizontal drains. Two deep wells, ranging in depth from 600 to 700 feet, would tap the underburden sandstones below the Mammoth coal seam, in those areas where subsidence-related fracturing had dewatered the shallow ground water system.

Disturbance associated with shallow well development would range from 0.25 to 1 acre per site. The deep wells could disturb as much as 3 acres during installation activities. The maximum cumulative disturbance associated with well development would be about 8 acres. Cut-and-fill material from well development would be equally balanced to eliminate excess material. The disturbed area would be immediately revegetated and enclosed with barbed-wire fencing to limit public/livestock access.

If appropriate, wells would be located along fencelines to provide maximum flexibility for livestock operators. All wells would be drilled and cased with 4.5- to 5-inch (inside diameter), steel, PVC, or other suitable pipe. Electric pumps would be used on the 2 deep wells and windmills would be used on the 2 shallow wells. Water storage and delivery systems would be built for each well.

e. Guzzlers

Newly-constructed guzzlers would be used to mitigate impacts at 2 isolated springs (see Table A-3 and Figure A-12). Guzzlers are permanent, self-filling water devices that catch and store rain water in a manner similar to a cistern. Installation of a guzzler would consist of a collecting apron, an enclosed, watertight storage tank, and a water-delivery system. Guzzlers would provide limited quantities of water in those areas where historic spring flow has been minimal and seasonal.

They are generally located in areas with gentle slopes and deep soil to permit burial of the storage tank. Collecting aprons consist of about 1,000 to 5,000 square feet of corrugated fiberglass or galvanized steel, elevated about 1 foot above the ground on a wooden or metal framework. Rainwater would be intercepted and drained from the sheeting into a collecting trough. It would then be piped into a large, 10,000 to 20,000 gallon, buried fiberglass storage tank. When needed, the stored water would be piped downslope from the tank by gravity flow to a small, 100-gallon trough/drinking pan, placed at ground level. The actual release of water into the trough would be controlled by a float-and-foot valve installed in the water line between the storage tank and the trough.

Disturbance from guzzler construction would range from one-half to 2 acres per site for a maximum cumulative disturbance of about 4 acres. Cut-and-fill material associated with guzzler development would be equally balanced to eliminate excess material. The disturbed area would be revegetated immediately and enclosed with barbed-wire fencing to limit public/livestock access.

f. Ponds (Reservoirs)

Newly-constructed ponds or reservoirs would be used to mitigate impacts at or near 4 springs and seeps. In addition, the existing pond at spring 14415 would be enlarged, and the existing ponds at 15 other springs may require repair (see Table A-3 and Figure A-12). Ponds would be used to collect and store surface water from direct runoff and from discharge from horizontal drains or vertical wells. Stored water would be used for replacement and augmentation of both spring flow and wetlands.

New ponds would be developed by excavating and constructing a dam or embankment directly across the drainage. Enlargement or repair of existing ponds would be accomplished by excavation and repair of the existing structure or the placement of a new dam across the valley bottom.

Disturbance from pond construction or repair would range from 0.1 to 1.0 acres per site, with a maximum cumulative disturbance at 20 sites of about 20 acres. All new embankments would be constructed by excavating a core trench into alluvial/colluvial material and compacting the backfill in 2-foot lifts. Water-holding capacity of all reservoirs (ponds) would be enhanced by deepening catchment or by installing diversion trenches to direct surface runoff waters into the basin. New construction or excavation would also incorporate the use of bentonite to reduce seepage loss. All impoundment designs would include spillways constructed to safely pass the excess water flow from the 100-year, 24-hour runoff event. Cut-and-fill material from pond development would be equally balanced to eliminate excess material. A water delivery system would be built with each pond. Disturbed area would be revegetated immediately and certain portions enclosed with barbed-wire fencing to limit public/livestock access.

g. Water distribution systems

Newly-constructed pipelines, irrigation troughs, or natural drainages would deliver excess water supplies throughout the life-of-mine area. A total of 4.0 miles of pipelines and/or irrigation troughs and 3.5 miles of repaired natural drainages would be used to supplement interrupted water supplies at 11 springs and seeps (see Table A-3 and Figure A-12).

In the steeper portions of basins where there is historic, perennial flow, the natural stream channel would be used to distribute water to downstream ponds or reservoirs. If necessary, the flow system within the drainage would be enhanced and, where appropriate, shallow surface-subsidence cracks would be repaired to insure water delivery.

Buried pipelines would be used to supply water to secondary sites in those areas where a horizontal drain, vertical well, or pond had been developed nearby, where sufficient unconsolidated material existed to allow easy excavation and minimal disturbance, and where a natural drainage could not be used. Irrigation troughs would be used in place of buried pipe where terrain or thin unconsolidated material was present. An advantage of pipelines and irrigation troughs is that they allow for the passage of water over subsidence cracks without loss. Each pipeline installation would consist of flexible pipe, buried at least 3 feet below the ground surface. Each irrigation trough installation would consist of an above-ground, open or closed pipe. Each secondary site would be developed with water storage and delivery systems as if it had a water source.

Individual pipeline/irrigation trough lengths range from a few hundred feet to a several thousand feet. Disturbance from water distribution activities would range from 1.5 to 2.0 acres per mile of distribution system. The maximum cumulative disturbance would be about 15 acres. Cut-and-fill material would be equally balanced to eliminate excess material. Disturbed areas would be revegetated immediately and, where appropriate, enclosed with barbed-wire fencing to limit public/livestock access.

9. Wetland Mitigation and Enhancement

Wetlands and associated vegetation disrupted as a result of mining-related subsidence (about 15 acres within the life-of-mine area) would be replaced as water sources were repaired, redirected, and/or developed (see Hydrologic Mitigation). While hydrologic development activities have the primary purpose of replacing water, wetland replacement would be a secondary benefit.

About 1 acre of scattered wetlands would be disrupted during construction activities along the proposed rail spur right-of-way. To mitigate this wetland loss, natural depressions along the right-of-way would be enlarged and graded to spread the water at a shallow depth across the depression.

In addition, wetland enhancement activities are proposed at certain water sources outside the life-of-mine area. These areas could eventually make up a 9-acre enhancement "bank" of wetland resources to temporarily mitigate Project-related wetland losses inside the life-of-mine area until scheduled wetland mitigation activities were complete. The "bank" of wetlands would be created on private lands in areas away from the mine site and its disruptive activities. These wetlands could serve wildlife and offer protection through topographic or vegetative features such as wind breaks or shading (see Table A-4). Selected wetland locations would be optimized for water-holding capacity and water-level maintenance. The enhancement "bank" may remain as wetland acreage after mine life even though other wetlands had been re-established.

About 2.5 acres of wetland enhancement would be initiated at 3 springs during Phase 1 mine development activities (see Table A-4 and Figure A-12). New ponds and associated wetlands would be developed in the vicinity of springs 11115 and 11125. A gravel pit located 1000 feet southwest of spring number 14785 would be enlarged and developed into a pond/wetland area. Horizontal drains would be established at spring 11115 and near spring 14785 to enhance the basic water supplies. Distribution systems would be installed to convey the excess water from spring 11115 to spring 11125 and from the horizontal drain near spring 14785 to a new pond at the gravel pit. The maximum cumulative disturbance from Phase 1 wetland enhancement would be 4 acres.

An additional 6.5 acres of wetland enhancement would be initiated at 13 other springs during Phase 2 mining activities (throughout the remainder of mine life). Enhancement activities at these springs would include enlargement of 5 existing ponds, creation of 9 new ponds, and drilling of 10 horizontal drains and 3 shallow wells (see Table A-4 and Figure A-12). Maximum cumulative disturbance from Phase 2 wetland enhancement would be 18 acres.

Cut-and-fill material associated with wetland enhancement activities would be equally balanced to eliminate excess material, as with all proposed spring development. A water delivery system would be developed for each site, and the disturbed area immediately revegetated. Certain portions of the disturbed area would be enclosed with barbed-wire fencing to limit public/livestock access.

TABLE A-4
Bull Mountains Mine No. 1
Wetland Enhancement Plan

Station	Surface Fracture Repair	Pond Repair	Pond Enlarge	Pond New	Horizontal Drain	Shallow Well	Deep Well	Guzzler	Distribution System	Comments
11115				X	X					
11125				X					X	From Spring 11115
14655			X X		X X					Develop Two Sites
14785			X		X				X	From Horizontal Drain and Spring 14785 to Enlarged Pond
17185			X			X				
17315			X							
41125			X		X					
52525				X	X					
52535				X	X					
52855				X		X				
53325				X	X					
53335				X	X					
71355				X	X					
71465				X		X				
72125				X	X					
72155				X	X					
Maximum Cumulative										
Numbers	0	0	6	11	12	3	0	0	2	
Acres	0.0	0.0	6.0	11.0	1.2	3.0	0.0	0.0	0.4	21.6 Acres

Ftnote: Columns for surface fracture repair, pond repair, deep wells, and guzzlers were included on this table to maintain csistency with Table A-3 even though none of these measures have been proposed for wetland enhancement.

10. Wildlife Mitigation

a. Wildlife habitat

Reclamation activities throughout the life-of-mine area would mitigate impacts to existing wildlife habitats by creating similar habitats in form and function. Vegetation species in proposed revegetation seed mixtures include 4 native shrub species selected for their palatability, and nutritional and cover values for locally-identified wildlife species (see Revegetation Operations). Native shrub seed and tree seedlings would be planted in concentrated pockets of varying sizes and shapes for use as wildlife forage and cover, respectively.

Undulations and small hills would be designed into the regraded final topography to enhance habitat diversity. In addition, 10-foot terraces, would be used on the north face of the WDA and ponderosa pine seedlings would be used to provide visual cover during wildlife movement.

Rock piles would be placed throughout the reclaimed surface facility complex, including the WDA, at a density of about 10 to 15 rock piles per 640-acre section, depending on the availability of material. Rock piles as large as 1,000 square feet would be placed along ridges, in bottomlands, and near stock ponds to mitigate the loss of rock outcrops that are used for raptor perching and mammal dens.

Fifteen acres of wetland habitat disturbed by subsidence would be replaced. One acre of scattered wetland habitat disrupted during rail spur construction would be replaced. In addition, an enhancement "bank" of wetland resources would be created outside the life-of-mine area to temporarily mitigate up to 9 acres of anticipated Project-related wetland loss during mine life (see Wetland Mitigation and Enhancement).

b. Hydrologic structures

Water delivery systems, consisting of either freeze-proof piping and watering troughs or some other appropriate mechanism, would be installed at each horizontal drain, vertical well, guzzler, and pond development to supply drinking water to wildlife and livestock.

Shorelines associated with pond (reservoir) construction or repair would be designed to provide easy access for wildlife and revegetated to insure adequate wildlife cover and forage.

All horizontal drain, well, guzzler, and pond developments would be fenced to prevent habitat degradation by livestock.

Design overflow areas would be maintained within the exclosure fence to preserve their availability for small game.

c. Other mitigation

Appropriate Federal and State wildlife agencies would be immediately contacted should any Federal- or State-listed endangered or threatened species, or golden eagles, consistently occupy the various Project areas or immediately adjacent areas.

All powerlines constructed for mining-related operations, would be designed to minimize collisions and electrocutions of raptors, waterfowl, and other wildlife species. Powerlines would be constructed in accordance with Rural Electric Association standards designed to reduce risk of electrocution to raptors (Ollendorff 1981).

Fences throughout the life-of-mine area and along the rail spur right-of-way would be constructed with steel posts and 3-strands of barbed wire. In hazardous or critical, newly-seeded areas, a 6- or 8-foot, woven-wire fence would be used to keep out wildlife. Otherwise, barbed wire would be spaced to ensure that fences would not restrict wildlife movements and migration. Sedimentation ponds associated with the surface facility complex would not be covered or enclosed by fencing that could deter wildlife.

Rock piles, brush, and other natural barrier materials would be used to supplement fencing and to create small mammal habitat and cover while still blocking livestock access around springs, guzzlers, ponds, and well development areas when topography and materials allowed.

Speed limits on all access roads would be restricted to 25 MPH to reduce wildlife/vehicle collisions.

Employees would be informed about Montana game laws and cautioned not to harass or poach game animals.

11. Environmental Monitoring

Environmental monitoring would be conducted on a regular basis to further define premining baseline environmental conditions and to detect mining-related changes from the baseline values. Operational and postmining data would be compared with premining data collected for the permit application. These comparisons would be used to design corrective measures during mine life, as needed.

In addition to vegetation, wildlife, subsidence, and hydrologic data collection, monitoring would be conducted for undetected cultural resources/Native American resources, airborne particulates, and soil suitability.

a. Vegetation

Monitoring would be conducted to assess the success of revegetation efforts in all disturbed areas within the life-of-mine area and the Huntley loadout. Revegetated areas would be evaluated for cover and density during the first 2 seasons following seeding or planting to determine initial revegetation success. Prior to application for bond release (in years 3, 5, 7, 9, and 10 following seeding or planting), revegetated areas would be evaluated for cover, density, production, and species diversity. If vegetation monitoring showed that corrective action was needed, then reclamation techniques and seed mixes would be revised to address the specific revegetation concerns.

b. Wildlife

Monitoring would be conducted to detect changes in wildlife concentrations or habitats during the mine life. This would include variations in species distribution or relative abundance and degradation of habitats for elk, mule deer, raptors, turkeys, and sharp-tailed grouse. Wetland and aquatic habitats would also be monitored. Monitoring activities would include field surveys, data compilation, impact assessment, and report preparation.

Field surveys would consist of aerial, vehicular, and footpath surveys. Censuses would be both visual and auditory. Seven aerial field surveys would be conducted annually; 2 in each of the fall, winter and spring seasons, and 1 during the summer. Footpath surveys in each of the 4 seasons, and vehicular and footpath surveys targeted at specific census targets and locations, would also be conducted.

The presence and distribution of breeding raptors in the area would be monitored annually. Observations of species or their sign would be recorded. Previously recorded nests would be examined for occupancy during the aerial surveys. In addition, each nest would be checked from the ground. All active nests would be monitored throughout the breeding season to determine success and production. Opportunistic observations made during aerial and ground surveys would be used to identify pairs of raptors not affiliated with a known nest in the area. If such a pair was located, the birds would be followed in an attempt to locate their nest. New nests would be monitored along with all other recorded nests.

Auditory censuses would be used each spring to assess the distribution and relative abundance of turkeys and breeding sharp-tailed grouse. The censuses would be conducted in the same manner as baseline data collection. Observation made during the aerial, vehicle, and footpath surveys would add to census results and provide incidental habitat use information. Although sharp-tailed grouse occurred in the area during the baseline data collection, only 1 lek was located. To ensure that other leks were not missed, auditory censuses would be conducted each spring. Attendance at each identified lek would be monitored annually for the duration of mining activities. This monitoring would consist of counting the number of male and female grouse attending each lek over 3 consecutive mornings.

c. Subsidence

Monitoring would be conducted to detect movements in the land surface. Monument grids would be placed over the mining panels, extending over the solid coal block, and surveyed to detect ground movements. The subsidence monitoring grid consists of 3 lines of monuments at 50-foot spacing across a portion of the first panel. Additional monuments, located at the center of other panels, would be spaced at 1,000 to 2,000 feet. All monuments would be constructed to ensure that they would not be affected by movements unrelated to subsidence, such as soil heave due to freezing.

Instrumentation for the first series of panels would include a precision level to measure vertical settlement and a steel tape extensometer to measure horizontal strain. Automatic data recording equipment would be used to take a continuous record of strain and tilt. Site-specific angle of draw, subsidence factor, and tensile strain would be calculated.

An additional monitoring system of multiple-position extensometers, or other suitable devices, would be installed to verify the mechanics of subsidence and to evaluate the caving and fracturing of the overburden. Strata movement measurements would be conducted in the life-of-mine area with 400 to 600 feet of overburden.

d. Hydrologic

Monitoring would be conducted to detect changes in 81 wells, 130 springs, 12 sites in 9 stream drainages, 57 ponds, and about 30 acres of wetlands associated with existing hydrologic features in and adjacent to the life-of-mine area. Monitoring would include both quantity and quality information. Observation frequency would vary from annual to quarterly depending on the size, use, and location of the feature (i.e., well, spring, pond) in question. Monitoring frequency could increase to a weekly basis as mining approached, then passed below, the location of the feature. When more frequent monitoring indicated that the effects of subsidence had been felt and the area stabilized once again, permission would be obtained from Montana DSL to reinstitute the original, less frequent monitoring schedule for that feature. Particular data to be collected would depend somewhat on the type of hydrologic feature being monitored. Wells would be monitored for water elevation and quality. Springs and ephemeral drainages would be monitored for flow rate and quality. Ponds would be monitored for water volume and quality and wetlands for areal extent and vegetation data.

APPENDIX B

SUMMARY DESCRIPTION OF CUMULATIVE DEVELOPMENT

INTRODUCTION

Several established business operations, expansion projects, and proposed activities in the study area could have cumulative effects on the human environment in combination with the proposed Project. The following paragraphs describe existing or expanding developments and new projects that may compete with the proposed Project for local employees or that may produce cumulative impacts in conjunction with the proposed Project.

1. PM MINE

The PM Mine is an underground coal mining operation consisting of 101.17 permitted acres located 16 miles southeast of Roundup, Montana in the W 1/2 of Section 13, and the NE 1/4 of Section 14, T6N, R26E MPM (see Figure B-1). RBM Mining extracts coal under a contract with Meridian Minerals Company (Meridian), which owns the mineral rights at the PM Mine. RBM Mining employs 6 workers and is currently permitted to remove 12,000 tons of coal up to the current permit boundary. Four underground mining portals have been constructed and the mine life is dependent on both market demand and the rate of advancement of the portals.

Coal from the PM Mine is extracted in a continuous-miner process, transferred to the surface by shuttle car, washed and stockpiled on site, and picked up at the mine by the purchaser. It is sold in the Roundup area and to a small Statewide market as "lump coal." Existing mine facilities include a scale; wash plant; four, 150-ton coal silos; a hopper unit; and a combined office and scale house.

Historical land uses for the PM minesite have been livestock grazing and wildlife habitat. The area was first mined in the 1930s as an underground coal mining operation, but it was converted by the owners, the Meged Family, into a surface coal mine in 1972. In the fall of 1991, the mine was converted back to underground mining when the present RBM Mining project commenced operation. Total coal production from 1973 to 1990 amounted to 228,573 tons.

2. COAL TEST PIT

The Meridian coal test pit is a surface mine developed by Meridian for the purpose of extracting up to 250,000 tons of coal for marketability testing. About 101 acres were ultimately permitted by Montana DSL for test pit operations, with 36 acres constituting the total disturbed area (see Figure B-1). Approximately 160,000 tons of coal were extracted using standard open pit techniques between November 1989 and November 1990. Clean coal for shipment totaled 130,000 tons. Peak employment during this period was about 20 employees, including 5 employees in supervisory positions. The coal was trucked to the Huntley loadout for ultimate shipment to foreign markets. Reclamation of the mined area began in late-1991 and continued into 1992.

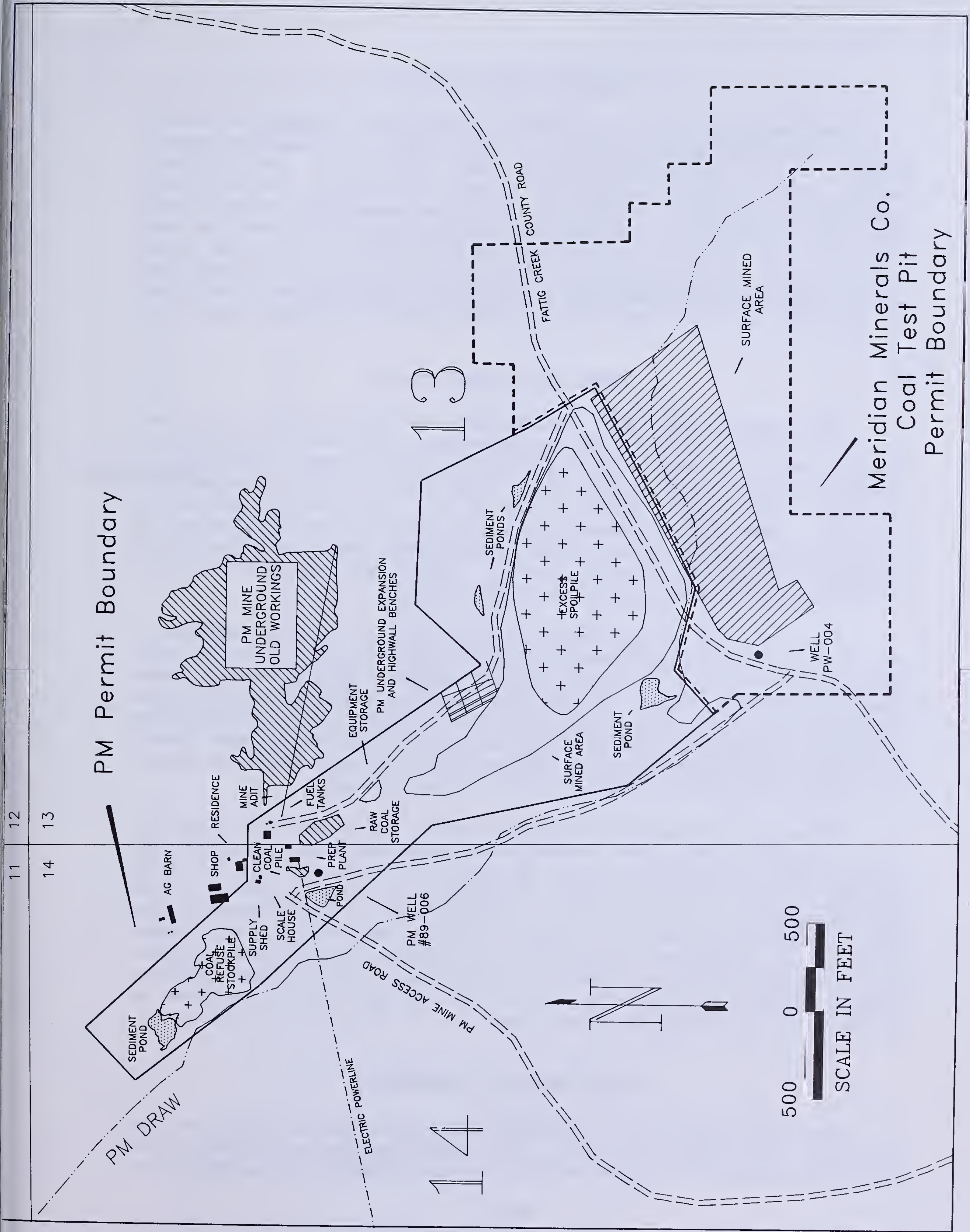

PM Permit Boundary
Meridian Minerals Co. Coal Test Pit Permit Boundary
PM MINE UNDERGROUND OLD WORKINGS
13
14
11
12
14
13
FATTIG CREEK COUNTY ROAD
SURFACE MINED AREA
SEDIMENT PONDS
EXCESS SPOILPILE
WELL PW-004
PM UNDERGROUND EXPANSION AND HIGHWALL BENCHES
EQUIPMENT STORAGE
SURFACE MINED AREA
SEDIMENT POND
RESIDENCE
MINE ADIT
FUEL TANKS
RAW COAL STORAGE
AG BARN
SHOP
CLEAN COAL PILE
PREP PLANT
POND
PM WELL #89-006
SUPPLY SHED
SCALE HOUSE
COAL REFUSE STOCKPILE
SEDIMENT POND
PM DRAW
ELECTRIC POWERLINE
PM MINE ACCESS ROAD
N
500
0
500
SCALE IN FEET

Figure B-1 Existing buildings and facilities at the PM Coal Mine and coal test pit

3. HUNTLEY LOADOUT FACILITY

The Huntley loadout is a 6.07-acre rail support facility located in the NE 1/4 of the NE 1/4 Section 25, T2N, R27E in Yellowstone County, Montana, on the east edge of Huntley (see Figure B-2). The loadout's surface area consists partly of gravel and partly native range. Washington Corporations, through its railroad subsidiary, Montana Rail Link, owns the facility. The site has electrical service. Water for dust control is available from a well completed by Meridian in 1990. In recent years, horses have been grazed on the land for short periods of time. The southwest portion was established as a temporary coal loadout by Meridian, in its 2-year test pit permit, from November 1989 to November 1991.

4. SUGAR BEET LOADING SITE

The Huntley sugar beet loading and stockpiling site is located directly west and adjacent to the existing coal loadout facility in Huntley (see Figure B-2). The property is owned by Montana Rail Link and leased to Western Sugar Company (WSC). WSC uses the site to temporarily stockpile beets before they are hauled to a processing factory in Billings. Sugar beets received from local farmers are stockpiled during the peak harvest month of October and subsequently hauled to a factory in Billings from October through January. Total WSC employment at the stockpile usually averages between 4 and 6 workers.

Since 1985, sugar beet truck traffic from local farmers hauling to the stockpile has varied from 830 loads in 1985 to 4,252 loads in 1990. Most field harvest traffic has occurred in October, usually 10 to 12 hours per day, 6 days per week. In 1990, the average truck traffic from farms to the stockpile was 177 trips per day over a 24-day period. Peak hauling during 1990 occurred on October 13 and involved 281 trips from area farms. Most farm truck traffic arrives at the stockpile using Northern Avenue from the west and east, and Heath Street from the north.

Beets are subsequently re-hauled from the loading site to the factory in Billings. This activity fluctuates annually, but from 1988 through 1990 the average was about 35 loads per day for 26 days per year. Hauling usually occurs daily, throughout a 24-hour period, with intermittent breaks as dictated by factory needs. Peak hauling in 1990 was 69 loads on October 21, with 60 or more loads occurring on 3 other days. Beet hauling is usually contracted with a local trucking firm. Trucks normally haul to the factory in Billings by turning west from the loadout facility site onto Northern Avenue, and by taking Interstates 94 and 90 to the exit ramp at 27th Street.

5. FERGUS ELECTRIC COOPERATIVE

As a power distribution cooperative, Fergus Electric does not own any power generation facilities. Its subtransmission and distribution system is served by 19 substations. Fergus Electric Cooperative was

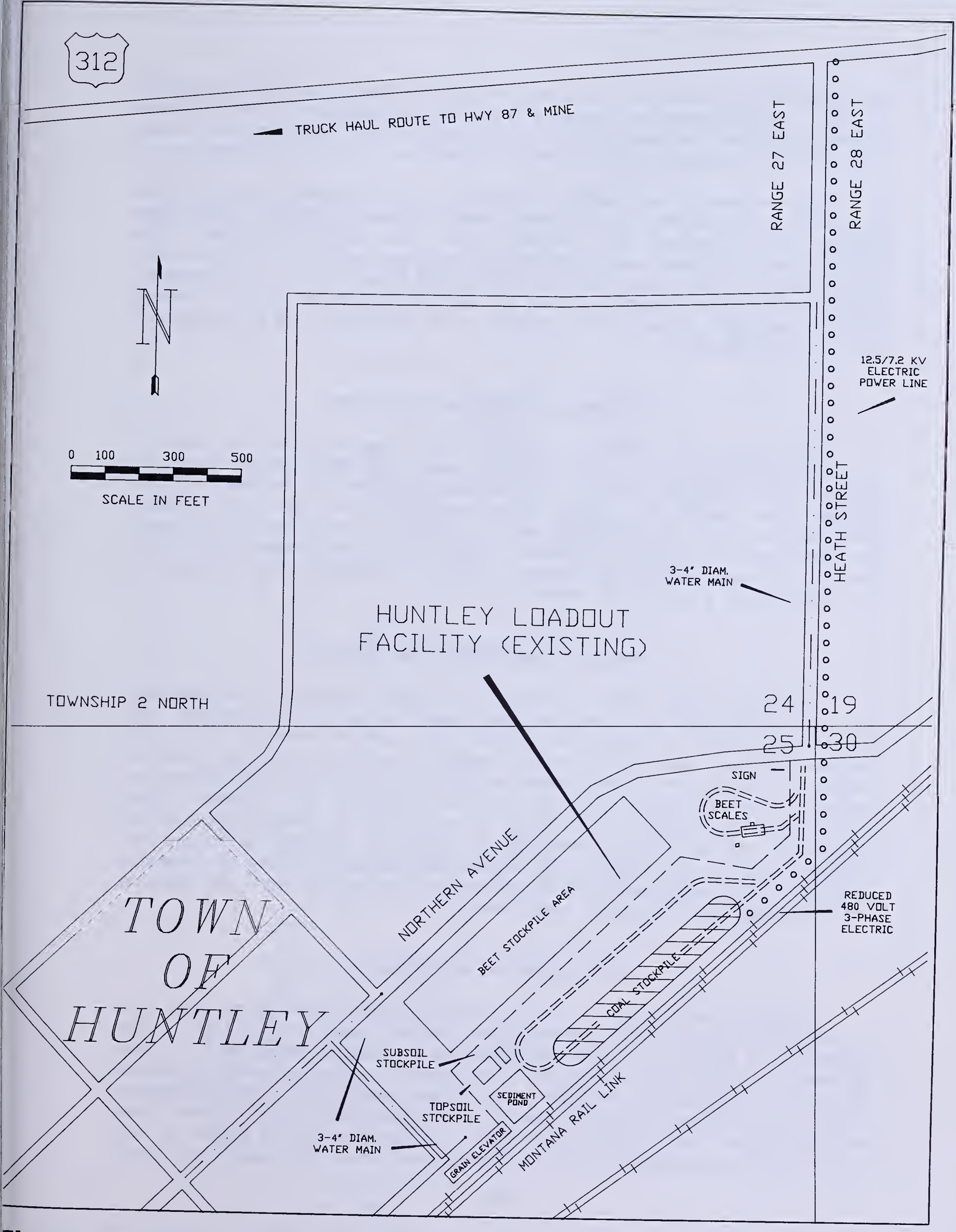

312
TRUCK HAUL ROUTE TO HWY 87 & MINE
RANGE 27 EAST
RANGE 28 EAST
N
0 100 300 500
SCALE IN FEET
12.5/7.2 KV ELECTRIC POWER LINE
HEATH STREET
3-4" DIAM. WATER MAIN
HUNTLEY LOADOUT FACILITY (EXISTING)
TOWNSHIP 2 NORTH
24
19
25
30
SIGN
BEET SCALES
NORTHERN AVENUE
BEET STOCKPILE AREA
COAL STOCKPILE
REDUCED 480 VOLT 3-PHASE ELECTRIC
TOWN OF HUNTLEY
SUBSOIL STOCKPILE
TOPSOIL STOCKPILE
SEDIMENT POND
GRAIN ELEVATOR
MONTANA RAIL LINK
3-4" DIAM. WATER MAIN

Figure B-2 Existing Huntley loadout, beet-loading facility, and grain elevator incorporated in 1938 under the authority of the Rural Electrification Act of 1935. Fergus Electric serves a 13-county geographical area centered around Lewistown, and supplies power to about 2,700 customers over about 4,000 miles of subtransmission and distribution lines (see Figure B-3).

System power is purchased through the Central Montana Electric Power Cooperative, an electric power broker that purchases wholesale power from Montana Power Company and Western Area Power Administration. The cooperative's customer base is primarily rural residential and irrigators. Large commercial customers include the Kendall Mine, BER Oil, and PM Mine. Annual Power sales average 70 to 80 million kilowatt hours. Fergus Electric employs a total of 24 people; 21 in Lewistown and a maintenance crew of 3 in Roundup.

6. WOMEN'S CORRECTIONAL FACILITY

The State of Montana proposes to construct a new Women's Correctional Facility in the Billings area near 32nd Street West and Hesper. The present facility for women prisoners is located in Warm Springs and would be closed upon completion of the new prison. Construction of the proposed $10 million facility should begin in January 1993 and last for about 18 months. Construction employment would total 50-100, and operation of the 120-bed facility eventually would employ 80 to 90 people on a permanent basis.

7. CENEX HYDROSULPHURIZATION PROJECT

Cenex operates a fuel refinery in Laurel, Montana, that produces asphalt, diesel fuel oil, gasoline, and liquified petroleum products. The refinery has been in operation since 1930, with a capacity of 42,000 barrels per day, and is expected to continue operations for at least 44 years. In May of 1992, Cenex began construction on a hydrosulphurization project that is also located at the refinery in Laurel. The hydrosulphurization project, which is expected to become operational toward the end of 1993, is strictly a mitigation project to reduce air emissions and is not expected to expand the number or value of products produced. The construction phase is expected to employ about 400 workers who are being hired from the local area.

8. COGENERATION PROJECT

Billings Generation, Inc. is in the permitting process to construct a proposed $150 million cogeneration project east of Billings. The cogeneration plant would use refinery coke and return steam to the Exxon refinery to be used in production. The project is also expected to reduce sulphur dioxide emissions from the Exxon refinery. If permitting continues as planned, construction of the project would begin in fall 1992 and operations would commence in 1994. The construction phase of the project would employ 400 to 500 workers hired from the local work area.

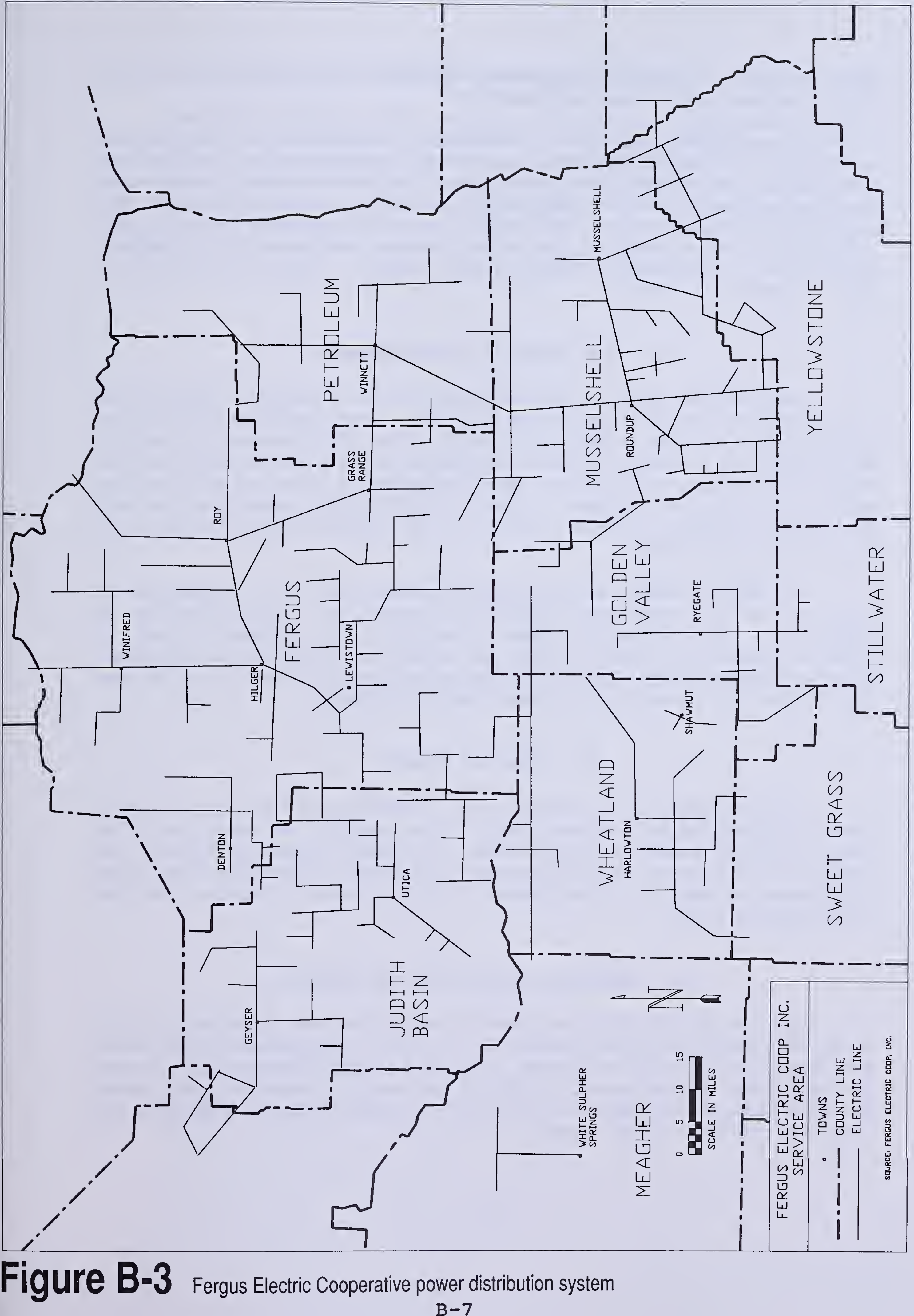

PETROLEUM
WINNETT
GRASS RANGE
ROY
MUSSELSHELL
MUSSELSHELL
ROUNDUP
YELLOWSTONE
FERGUS
WINIFRED
HILGER
LEWISTOWN
GOLDEN VALLEY
RYEGATE
STILLWATER
WHEATLAND
SHAWMUT
HARLOWTON
SWEET GRASS
DENTON
UTICA
JUDITH BASIN
GEYSER
WHITE SULPHER SPRINGS
MEAGHER
N
0 5 10 15
SCALE IN MILES
FERGUS ELECTRIC COOP INC. SERVICE AREA
TOWNS
COUNTY LINE
ELECTRIC LINE
SOURCE: FERGUS ELECTRIC COOP, INC.

Figure B-3 Fergus Electric Cooperative power distribution system

When complete, the project's permanent employment requirements would be 30 direct workers and 15 secondary workers.

If permitting continues as planned, construction of the project would begin in spring 1992 and operations would commence in 1994. A construction contractor based in California has been selected; however, it is expected to subcontract for employees in the local work area. The project would employ 400 to 500 construction workers, primarily pipefitters. When complete, it would increase employment by 30 direct workers and 15 secondary workers (Owen Orndorff, Billings Generation, Inc., November 7, 1991).

9. U.S. HIGHWAY 87 IMPROVEMENTS

The State of Montana has two reconstruction projects planned for U.S. Highway 87 between Roundup and Billings. Reconstruction of 6.2 miles of U.S. Highway 87 is scheduled to begin after 1993 between milepost 23 and milepost 29.2, several miles south of the south entrance to Old Divide Road. The construction period should last about a year and would employ between 50 and 100 workers. Truck traffic from reconstruction may periodically total 20 trucks per hour. The trucks would be similar in size to coal haul trucks.

The other reconstruction project planned for U.S. Highway 87 is north of the proposed coal haul route from Klein to the junction of Highway 12. This project includes 1.8 miles of U.S. Highway 87 and 1.1 miles of Highway 12 (from the junction with U.S. Highway 87 to Roundup). Depending on the contractor, truck hauling related to this project may use U.S. Highway 87 south of the reconstruction project.

10. SEALEY'S SAWMILL

Sealey's Sawmill is located east of Roundup on Highway 12 and is owned and operated by Lawrence Sealey. The sawmill, in operation since 1948, currently produces rough lumber and timber, dimension lumber, and firewood. Employment usually averages 8 people, but the firm also hires contractors as needed. At the present time, the sawmill obtains logs from the Lewistown area.

11. GEBHARDT'S POST PLANT AND SAWMILL

Gebhardt's Post Plant and Sawmill is located west of Roundup and is owned and operated by Monte Gebhardt. The mill, in operation since 1985, produces timbers, posts and poles, rough and surfaced timber, and treated wood products. Due to recent layoffs at the sawmill operation, employment has been reduced to 2 workers. The mill currently obtains logs from the Lewistown and Musselshell areas.

12. BURLINGTON NORTHERN RAILROAD

Burlington Northern (BN) owns tracks that are located near Broadview and connect Great Falls to the Montana Rail Link tracks at Mossmain, several miles east of Laurel, Montana (see Figure B-4). BN employs approximately 125 workers in the Billings area. The largest operation is the rail welding plant in Laurel, employing about 100 workers. The Great Falls/Mossmain tracks were built in the early-1900s and are currently used by 2 to 4 trains per day between Shelby and Mossmain.

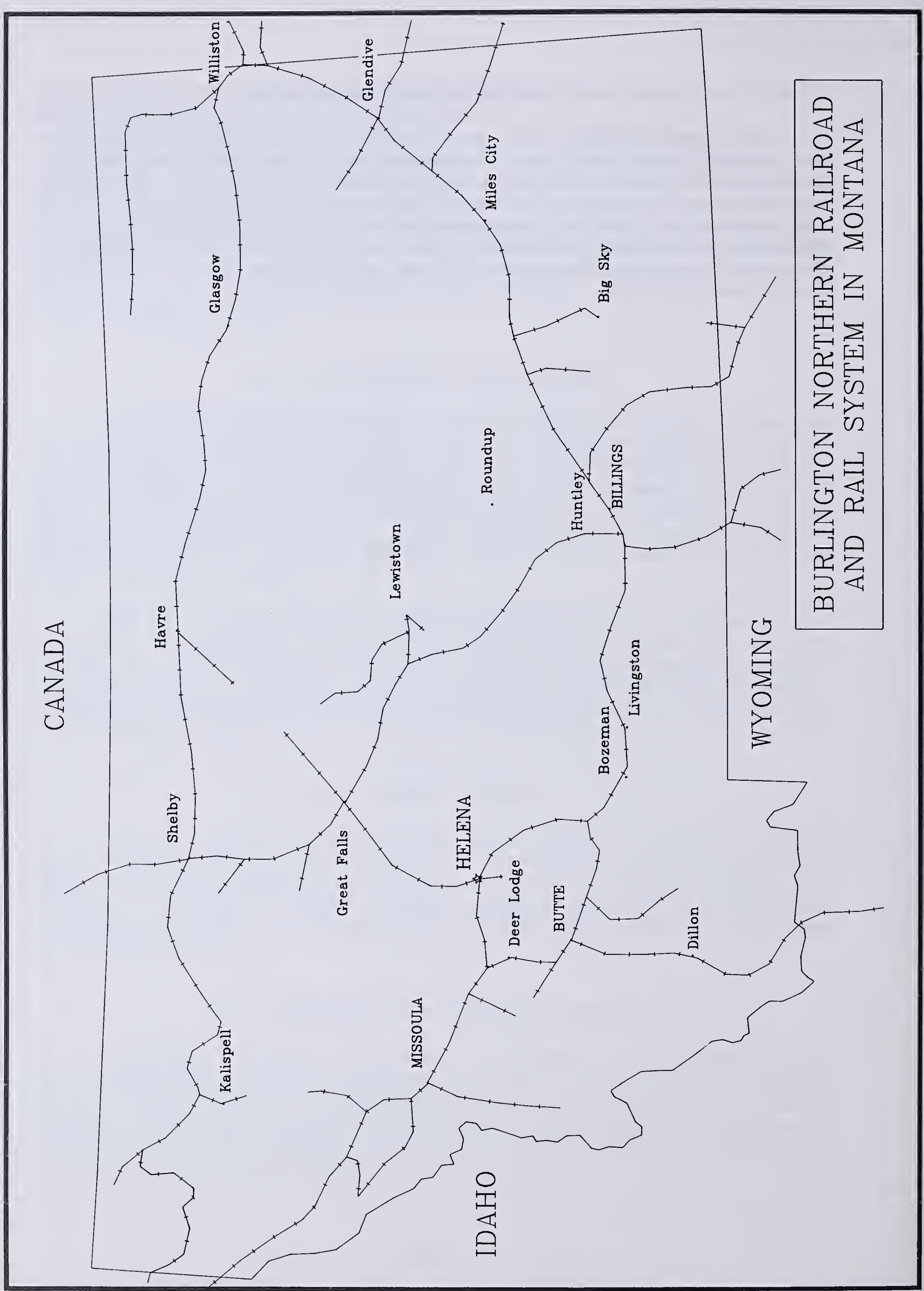

BURLINGTON NORTHERN RAILROAD
AND RAIL SYSTEM IN MONTANA
CANADA
WYOMING
IDAHO
Williston
Glendive
Miles City
Big Sky
Glasgow
Roundup
Huntley
BILLINGS
Lewistown
Havre
Livingston
Bozeman
Shelby
HELENA
Great Falls
Deer Lodge
BUTTE
Dillon
MISSOULA
Kalispell

Figure B-4 Burlington Northern Railroad and rail system in Montana

APPENDIX C

UNDERGROUND MINING OF COAL

Mining Methods and Equipment
and
Mechanisms of Subsidence

1. INTRODUCTION

Coal mining involves the extraction of coal deposits. Although the thickness of a coal bed may vary, mined deposits generally are continuous over large areas. When the deposit is close to the ground surface (less than 200 feet deep) generally it is mined using open-pit, surface methods. Deeper deposits must be mined by underground methods.

Rocks above and below the coal deposit are known as overburden and underburden. Rocks of the overburden and underburden that are actually in contact with coal are called the "roof" and "floor", respectively. Blocks of coal left in place to help support the roof of the mine are called "pillars".

Removal of coal by underground methods creates a void in the rock column. As a block of coal is extracted, natural forces act on the stability of the overburden and cause the column to subside. Even in the strongest rock formations, large, artificial underground openings will eventually be filled by the collapse and compaction of overburden and pillars. Underground mining methods are generally classified or distinguished from each other by the type of support used to prevent the roof from collapsing prematurely on workers and equipment.

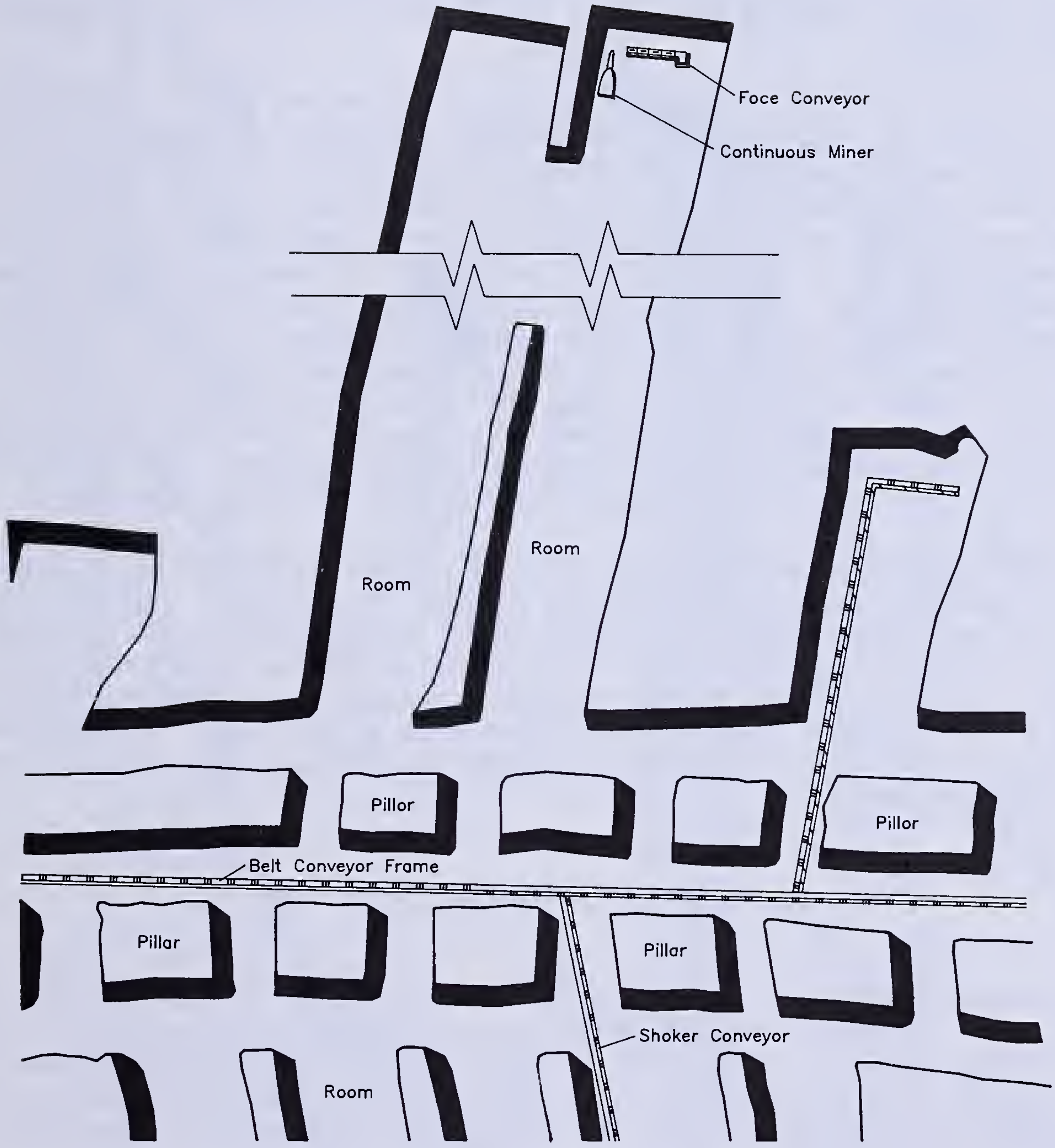
2. ROOM-AND-PILLAR MINING OPERATIONS

Room-and-pillar mining is generally defined as "a system of mining in which part of the coal is mined out and the rest is left in place as pillars for support" (Stout 1980). It involves the partial removal of coal from a series of small areas or "rooms" that are large enough to make the removal of coal economical, yet small enough to leave remaining walls and pillars that are of adequate size to support the roof and ensure the safety of both workers and their mining equipment (Figure C-1).

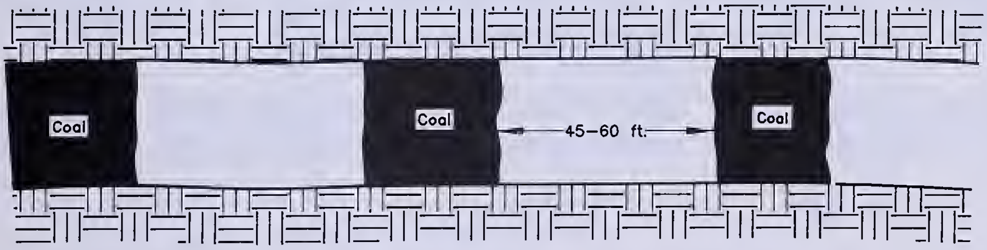
Room-and-pillar operations are generally conducted with a continuous-miner system, which includes:

- a coal extraction machine (continuous miner)
- a coal haulage system (shuttle cars and conveyor belts)
- a roof support system (roof bolts and pillars).

The continuous miner is electro-hydraulically powered and cat-track propelled. Major components of this machine include a rotating-cutting drum, a gathering head, and a conveyor. Operation of the machine at the working face of the coal involves driving the rotating-cutting drum at the front (head) of the machine into the coal bed, thereby cutting coal from the coal face. The gathering head shifts the cut coal to the conveyor for transfer to the rear (tail) of the machine. An articulating conveyor then transfers the coal to shuttle cars.


Foce Conveyor
Continuous Miner
Room
Room
Pillar
Pillar
Belt Conveyor Frame
Pillar
Pillar
Shoker Conveyor
Room

Plan View


Coal
Coal
45–60 ft.
Coal

Cross Section

Figure C-1 Conceptual room-and-pillar mining

Shuttle cars are used to transport mined coal (10 to 15 tons per car) from the continuous miner to a conveyor belt transfer point within the mine. The cars are either electric or diesel powered, 2- or 4-wheel drive, and have either a conveyor or push-ram system to discharge the coal. Additional conveyor belts transport coal to a run-of-mine (ROM) coal stockpile outside the mine portal.

Pillars and roof bolts are used to support the roof. Solid pillars of coal are left in place during the initial (advance) mining stage to provide basic roof support within each block of mined-out coal and along the main access corridors (entries) of the mine. Additional roof support is provided by the use of roof bolts. Roof bolts are long steel rods, drilled into place and then anchored to the roof rock by either a resin glue or a mechanical compression device. They create a supporting "beam" of rock by bonding or "bolting" several layers of rock strata together. The general mining/production sequence allows for the continuous miner to advance about 20 feet before the roof of the mined area is secured with roof bolts. Several continuous-miner sections (entries) are usually developed concurrently to allow for uninterrupted mining activity (i.e., while roof bolts are being installed in some entries, mining can continue in other entries).

As a general rule, 30 to 60 percent of the coal remains in place in the form of pillars after the rooms are mined. To increase coal recovery, the roof can be temporarily reinforced with additional bolts so that those pillars not required for support of the main entries can be systematically removed. In this second stage of mining, pillars are removed (or "robbed") as the mining equipment "retreats" from each mined room. As pillar-robbing progresses, each mined-out block of rooms is allowed to cave in and the mined area is abandoned.

3. LONGWALL MINING OPERATIONS

Longwall mining is generally defined as "a system of mining whereby most of the coal is mined and the roof over the worked out area is allowed to cave" (Stout 1980). It involves a complete, single-stage extraction of coal that uses hydraulic equipment to temporarily support the roof during coal removal activities and ensure the safety of both workers and their mining equipment (Figure C-2).

Longwall operations begin with continuous-miner equipment and room-and-pillar techniques to create a set of parallel entries on either side of a large block (or "panel") of coal. These entries are connected at the far end of the panel, resulting in a long corridor, thus the "longwall". The distance between the entries is equal to the length of the longwall equipment that will be used (ranging from 520 to 840 feet).

Longwall operations are generally conducted with a longwall mining system. As with the continuous miner, the longwall system would include:

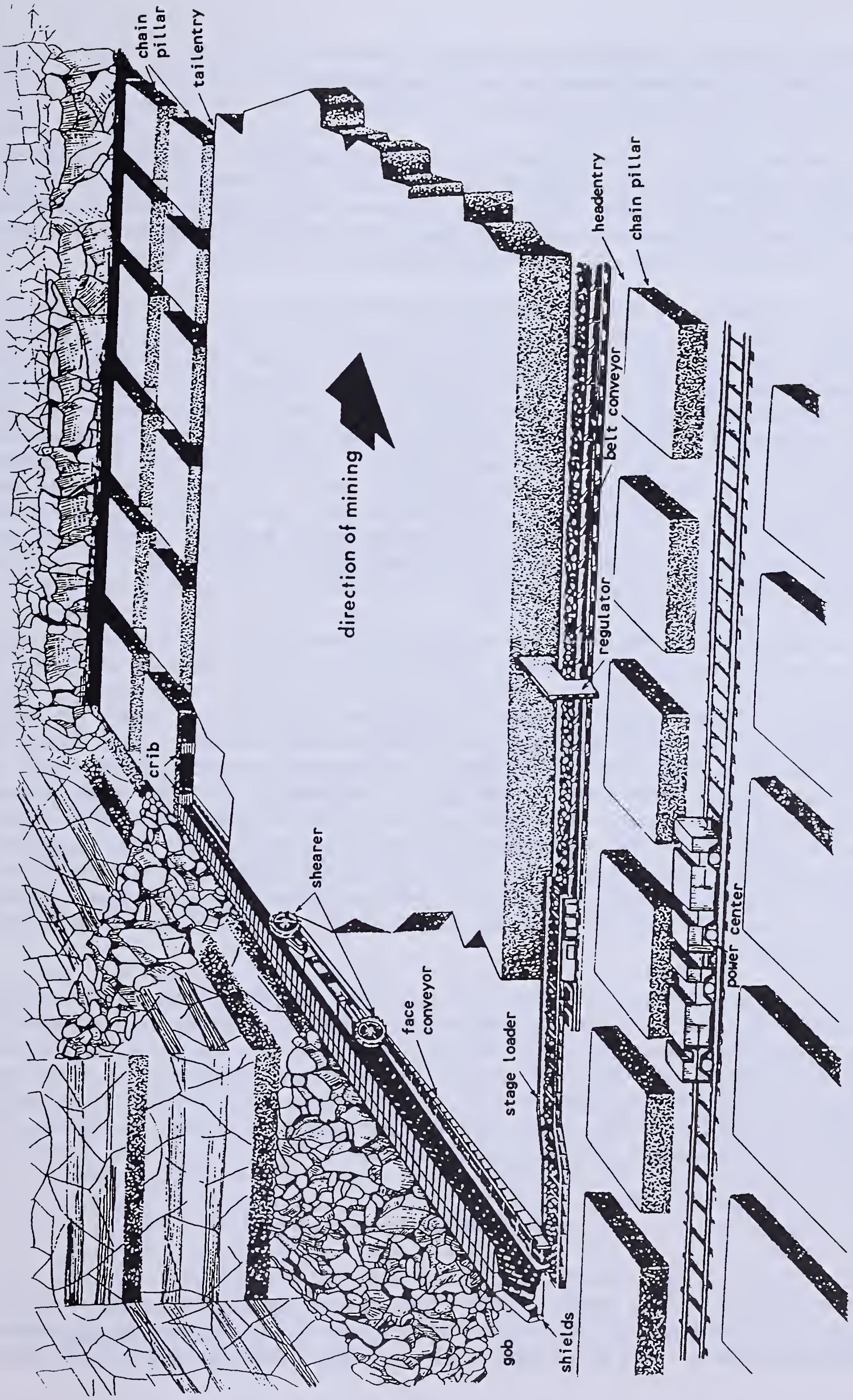

chain pillar
tailentry
headentry
chain pillar
belt conveyor
direction of mining
regulator
crib
shearer
face conveyor
stage loader
power center
gob
shields

Figure C-2 Conceptual longwall mining

- a coal extraction machine (shearer)
- a coal haulage system (face conveyor)
- a roof support system (shields)

While the continuous-mining system employs several independently-operated pieces of equipment to mine coal, the longwall mining system is totally integrated, with all of the necessary equipment interconnected. For example, in the longwall mining system, the shearer actually moves along the face conveyor and the shields are physically connected to it.

The shearer, like the continuous miner, is electro-hydraulically powered. The major components of this machine are the rotating-cutting drums and the tram system. The drums, located at each side of the machine, are limited to an up-down movement. Operation of the shearer at the working face involves driving the rotating-cutting drums into the coal bed as the machine trams laterally along the face conveyor, thereby cutting coal from the coal face. Cut-coal falls to the floor-supported face conveyor for transport to the end of the longwall or "headgate". Here the coal is transferred to another conveyor belt. The end of the conveyor opposite the headgate is known as the "tailgate." As in the continuous-miner system, additional conveyor belts transport the coal from the belt-conveyor transfer point to a ROM coal stockpile outside the mine portal.

Longwall roof support is temporarily provided by the use of hydraulic roof supports (shields). Major components of the shields include canopy, hydraulic cylinder, hydraulic controls, and the base. The canopy is a thick, reinforced, steel plate which is pushed against the roof by hydraulic cylinders to support the weight of the overburden while coal removal operations continue below. Shields are generally 5-feet wide, vary from 7- to 14-feet high, and have a design-load capacity of 500 tons or more per shield. The base length of the shield is relatively short, allowing the face conveyer to sit on the floor ahead of the base. Shields are designed to be large enough to safely cover the face conveyor, shearer, and workers. In the longwall system, a series of individual shields are installed next to one another along the entire longwall face, from the face conveyor headgate to its tailgate.

The mining/production sequence involves cutting (shearing) a section of coal face, typically 30 to 42 inches deep, from the headgate to the tailgate, using hydraulic rams to move the face conveyor up against the face of the fresh-cut coal seam. Hydraulic rams attached to the face conveyor then move individual shields forward. The unsupported roof behind the shields is allowed to fall to the floor. As the block of coal is systematically removed, mined area is gradually abandoned.

4. MECHANISMS OF SUBSIDENCE

Removal of coal deposits by underground mining methods creates voids that are filled when natural forces overcome the stability of the overburden and it collapses. The collapse of overburden into the void, and translation of this movement to the surface is known as subsidence. Subsidence-related deformation of rocks above underground mines can consist of fragmentation, fracturing, sagging, and bedding-plane separation. The type of deformation that occurs depends on a number of factors including rock strength, mine layout, and how far a particular horizon lies above the void in the mined area. Subsidence-related deformation of the surface can consist of basins or depressions, pits, and/or cracks. The magnitude, extent, and duration of subsidence can be minimized by an efficient mine layout, barrier and pillar design, and a rapid and efficient mining system.

a. Subsidence-Related Deformation

In the overburden above mined areas, 3 zones of deformation tend to develop in response to subsidence (Figure C-3). In the "Fragmented Zone", rocks of the immediate roof are expected to fragment, cave, and rotate. This zone can be as much as 10 times thicker than the void produced by mining (the mining height). Directly above, in the "Fractured Zone", rocks are expected to fracture and deform but they should maintain their continuity. Bedding plane separations can occur. This zone can be as much as 50 times thicker than mining height. In the third zone, the "Deformation Zone", rocks should sag downward without major fracturing but bedding-plane separations can still occur. This zone generally extends from the top of the fractured zone to the ground surface. After the deformation process, fractures that developed in softer sandstones and shales tend to close, while fractures that developed in more brittle rocks may remain open.

The surface expression of subsidence basically consists of basins or depressions, pits, and/or cracks. Subsidence "basins" form above room-and-pillar mines where pillars have been robbed or above longwall mines. These basins are typically elliptical or trough shaped because the rooms or panels are large and rectangular and coal seams often are nearly horizontal. Subsidence "pits" form above room-and-pillar mines where pillars have been retained because the overburden directly above the pillars continues to be supported, while the overburden above the mined area eventually collapses into the relatively smaller, mined-out rooms.

Horizontal strain, both tensile and compressive, results from lowering of the surface during subsidence. Tension that can cause cracks occurs as the surface begins to subside and stretch. Compression takes over and closes some of the tension cracks as the ground begins to settle. Corresponding changes in surface slope generally are temporary and often have a magnitude of less than 3 degrees. Tension cracks are more apparent than compression features because rocks are stronger in compression (Dunrud 1984). They are more abundant in solid rock than they are in unconsolidated materials. Tension cracks at the surface can range from small, (less than an inch) subtle features that are difficult to recognize to fractures several feet wide and up to 50 feet deep. Surface fractures may be temporary, often closing during successive subsidence events or after natural deposition of sediment or frost heaving fills them. Tension cracks over the edges of the mined area (the mining boundaries), may remain open indefinitely. This is most evident in those areas where brittle sandstones or other rocks crop out. The surface soil cover will have an influence on the cracking that is

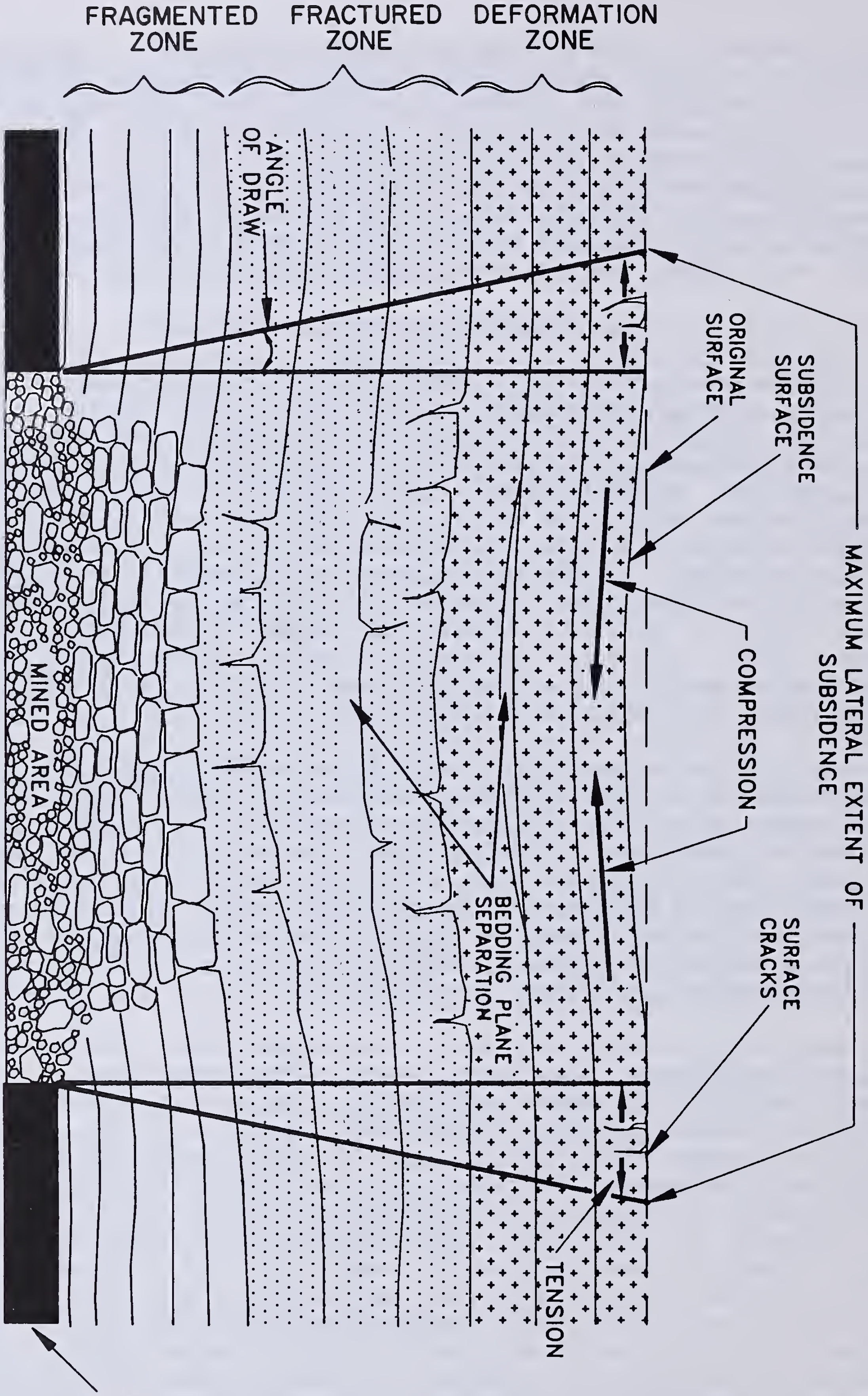

FRAGMENTED ZONE
FRACTURED ZONE
DEFORMATION ZONE
ANGLE OF DRAW
MAXIMUM LATERAL EXTENT OF SUBSIDENCE
ORIGINAL SURFACE
SUBSIDENCE SURFACE
COMPRESSION
SURFACE CRACKS
BEDDING PLANE SEPARATION
MINED AREA
TENSION
COAL SEAM

Figure C-3 Conceptual representation of subsidence deformation zones actually visible at the surface. Unconsolidated deposits of alluvium, colluvium, and soil tend to obscure surface cracks.

b. Factors Controlling Subsidence

Several factors control the area, amount, rate, and duration of subsidence. Mining factors include mine geometry, extraction ratio, mining method, height of the mine workings, and mining rate. Geologic factors include thickness of the coal deposit, and the thickness, lithology, strength, structure, and bulking factor of the overburden. The subsidence factor and the angle of draw are used to describe the maximum vertical displacement and the areal extent of subsidence, respectively.

The "mine geometry", or mine design, determines the size and configuration of the rooms, pillars, and panels, the height of the openings and pillars, and the spatial relation to any abandoned mines that may be located above the active mine. Generally mines are designed so that the subsidence process can take advantage of joints in the overburden. This can minimize sagging of the immediate roof and promote rapid roof collapse. Although subsidence can be reduced by leaving pillars for support, this procedure may only delay subsidence because pillars and roof rocks eventually yield with time and weathering.

The "extraction ratio" is the ratio of the amount of coal extracted to the total amount of coal in the deposit (Dunrud 1984). Longwall mining, because it extracts nearly 100 percent of the coal within a longwall panel, generally achieves an overall extraction ratio in excess of 80 percent of the total coal deposit. Room-and-pillar mining rarely extracts more than 55 percent of the total resource, but pillar robbing upon retreat from a mine has the potential to extract nearly as much of the coal as longwall mining.

The "mining method" also influences the amount of subsidence that occurs. Longwall mining results in more subsidence than room-and-pillar mining principally because of its greater extraction of coal. Efficient robbing of pillars, however, can result in surface subsidence nearly equal in magnitude to that associated with longwall mining. Subsidence above room-and-pillar mining areas is also less predictable and more variable in surface expression than above longwall panels because the extraction ratios and heights of caving are more variable (Dunrud 1984).

The "mining rate" affects subsidence too. When the mine face is extracted at an even and rapid rate, smoother subsidence profiles with less differential movement occur.

Thickness of the coal deposit, thickness of the overburden, and height of the mine workings control maximum subsidence. The "subsidence factor" is the ratio of maximum surface subsidence to the seam mining height and is often expressed as a percentage. For example, if 7 feet of subsidence occurred over a mine with a 10-foot mining height, then the subsidence factor would be 70 percent. In the western United States, subsidence factors range from about 45 to 90 percent of the thickness of coal mined (Dunrud 1984). The "angle of draw" identifies the limits of subsidence beyond the boundaries of the mined area (the subsidence occurring at the ground surface will be larger than the underground void). It is expressed in degrees from vertical above the edge of the mined area. For example, if the angle of draw were 27 degrees and the overburden were 400 feet thick, then subsidence could occur as much as 200 feet beyond the edge of the mined area. In the western United States subsidence angles of draw range from about 5 to 30 degrees (Dunrud 1984).

Sagging, caving, and fragmentation are governed by the "strength" and "structure" of the overburden. The composition of the mineral grains and cements that bind the grains together affect the strength of the rocks. Existing faults and fractures in the overburden offer good sliding surfaces that can influence the angle of draw. The strength and structure of the overburden rocks are considered when determining room, pillar, and panel orientation.

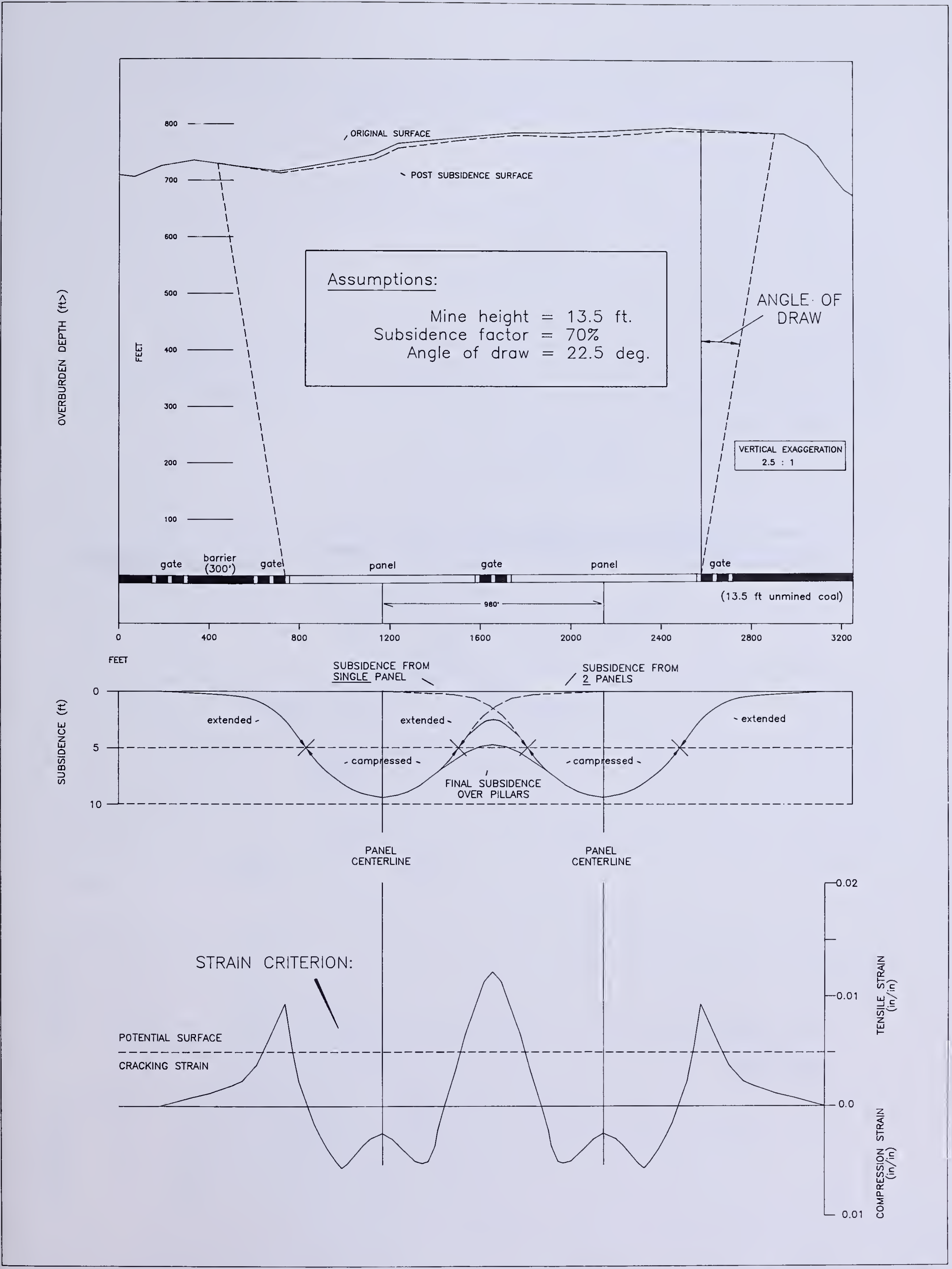
The "bulking factor", or the volumetric increase of fragmented rocks relative to their undisturbed and in-place volume, is a major factor controlling subsidence. The bulking factor is controlled by the size and shape of the broken rocks, the contact stresses among rock fragments within the fragmented zone, and the relative strengths of the affected rocks (Dunrud 1984). Bulking factors generally are lowest where the overburden is composed of soft claystones and thinly bedded shales, and greatest where hard, thickly bedded to massive sandstones and limestones predominate. If rock fragments fall to the floor of the mined area in a random fashion, and if strong, massive rocks occur in the fractured and deformation zones, then the bulking factor is higher. Higher bulking factors in the overburden result in less vertical movement of the rocks and reduced tension and compression at the surface.

c. Prediction of Subsidence

Subsidence associated with underground mining is anticipated and its magnitude and extent can be predicted. Often, predictions of maximum surface subsidence and horizontal tensile and compressive strains are used to help assess the secondary impacts to other resources (both human and natural). Data collected during actual subsidence are used to verify premining predictions.

A method of calculation developed by the British National Coal Board (Subsidence Engineers' Handbook 1975) offers one of the most comprehensive, conservative, and accurate techniques for predicting subsidence and surface strains. Other researchers have modified it for the stronger strata of coal mines in the western United States (Maleki 1987; Western Fuels Association, Inc. 1981). Inputs to the subsidence prediction model are depth, mining height (seam thickness), and room or panel geometry.

"Subsidence profiles" can be used to illustrate subsidence and strain predictions above a mined area. Diagrams A, B, and C of Figure C-4 show a cross section of a longwall mine and the subsidence and strain profile that might be expected to develop over 2 mined-out longwall panels. In this example, the longwall panels are 800 feet wide, overburden is about 780 feet


OVERBURDEN DEPTH (ft>)
FEET
800
700
600
500
400
300
200
100
ORIGINAL SURFACE
POST SUBSIDENCE SURFACE
Assumptions:
Mine height = 13.5 ft.
Subsidence factor = 70%
Angle of draw = 22.5 deg.
ANGLE OF DRAW
VERTICAL EXAGGERATION 2.5 : 1
gate
barrier (300')
gate
panel
gate
panel
gate
980'
(13.5 ft unmined coal)
0
400
800
1200
1600
2000
2400
2800
3200
FEET
SUBSIDENCE FROM SINGLE PANEL
SUBSIDENCE FROM 2 PANELS
SUBSIDENCE (ft)
0
5
10
extended
extended
extended
compressed
compressed
FINAL SUBSIDENCE OVER PILLARS
PANEL CENTERLINE
PANEL CENTERLINE
STRAIN CRITERION:
POTENTIAL SURFACE
CRACKING STRAIN
0.02
0.01
0.0
0.01
TENSILE STRAIN (in/in)
COMPRESSION STRAIN (in/in)

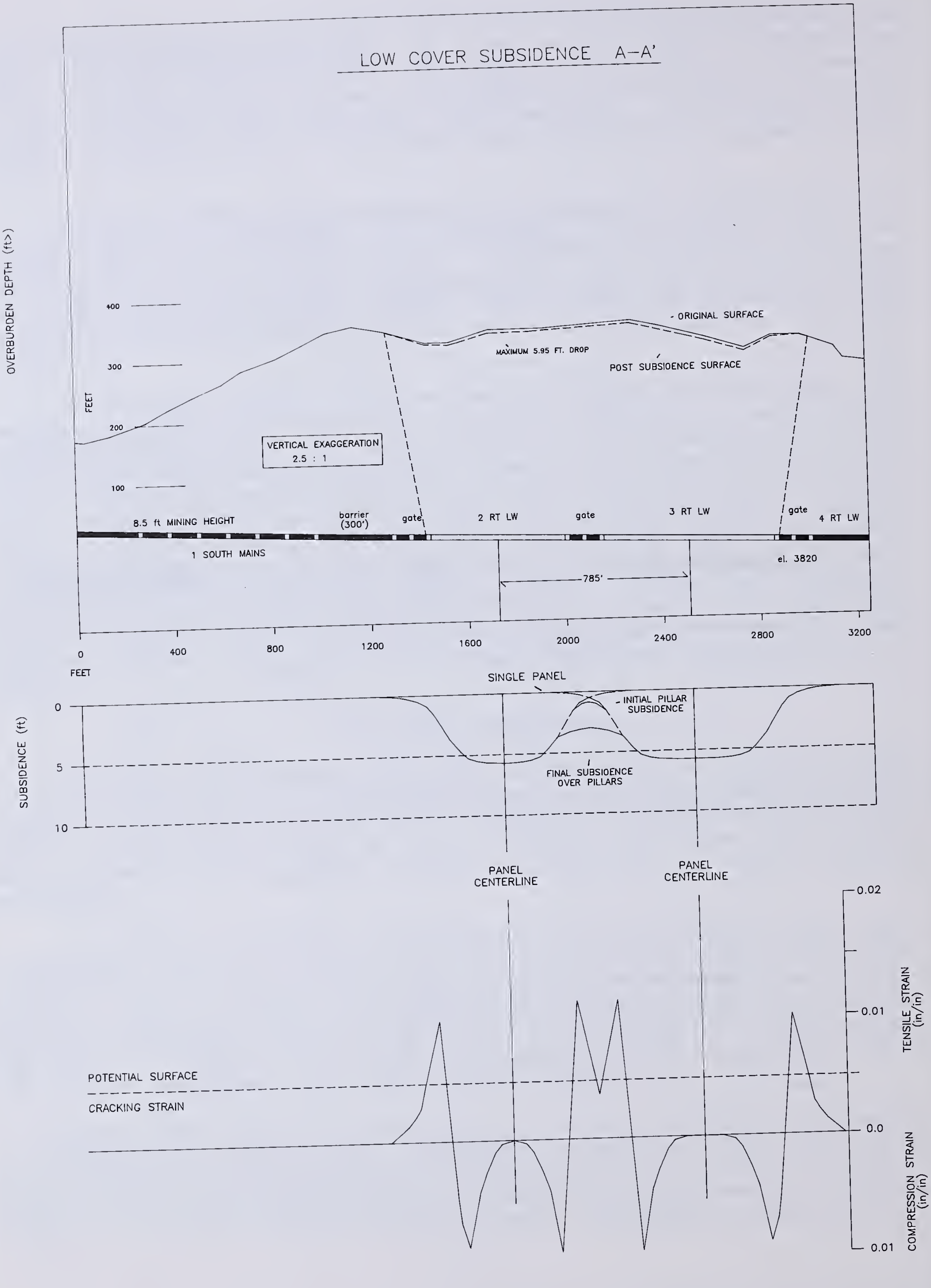
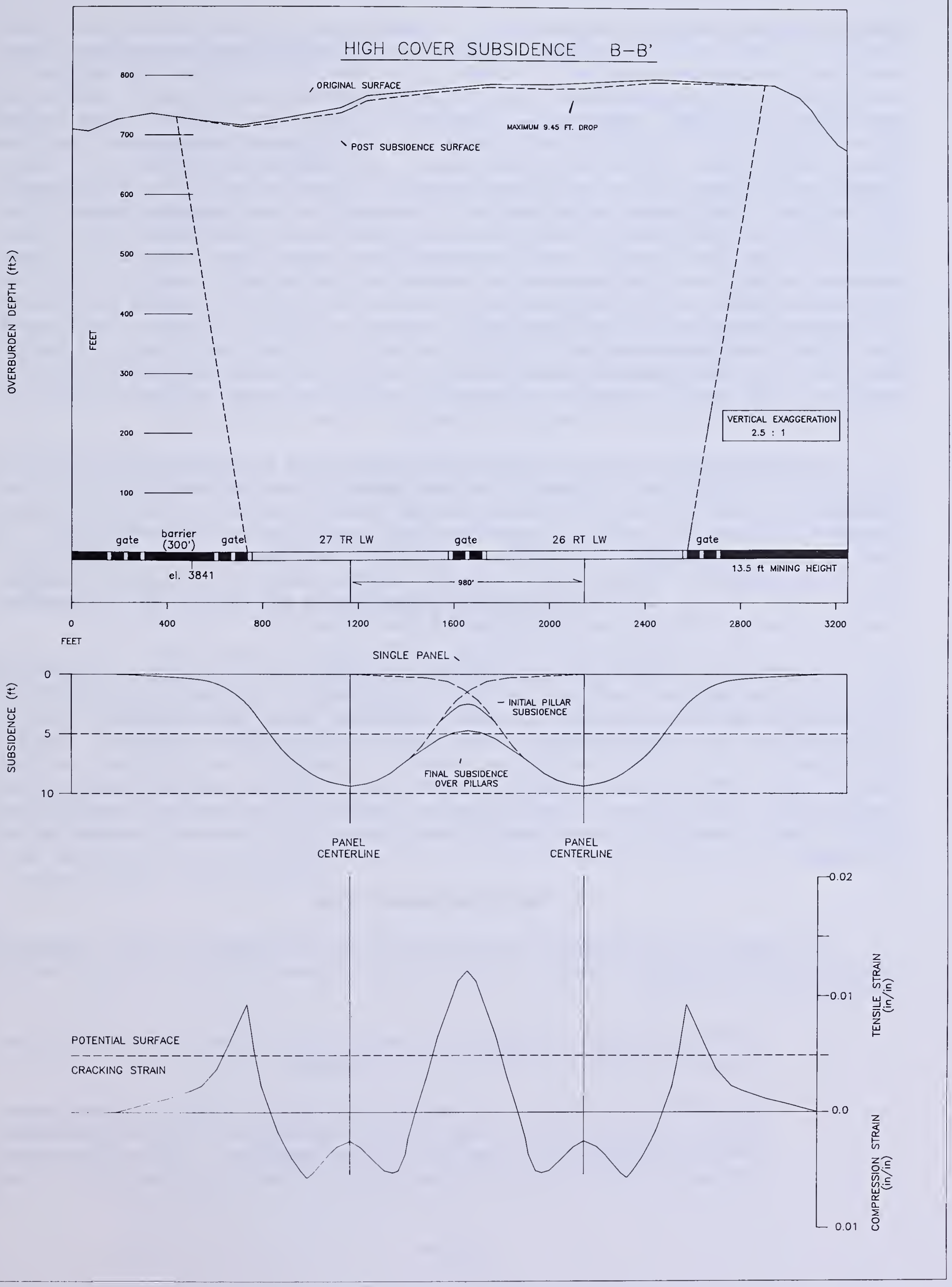

LOW COVER SUBSIDENCE A–A'
OVERBURDEN DEPTH (ft>)
FEET
400
300
200
100
ORIGINAL SURFACE
MAXIMUM 5.95 FT. DROP
POST SUBSIDENCE SURFACE
VERTICAL EXAGGERATION
2.5 : 1
8.5 ft MINING HEIGHT
barrier
(300')
gate
2 RT LW
gate
3 RT LW
gate
4 RT LW
1 SOUTH MAINS
el. 3820
785'
0
400
800
1200
1600
2000
2400
2800
3200
FEET
SINGLE PANEL
INITIAL PILLAR SUBSIDENCE
FINAL SUBSIDENCE OVER PILLARS
SUBSIDENCE (ft)
0
5
10
PANEL CENTERLINE
PANEL CENTERLINE
POTENTIAL SURFACE
CRACKING STRAIN
0.02
0.01
0.0
0.01
TENSILE STRAIN (in/in)
COMPRESSION STRAIN (in/in)

Figure C-4 Example of subsidence and strain profiles


HIGH COVER SUBSIDENCE B–B'
800
700
600
500
400
300
200
100
OVERBURDEN DEPTH (ft>)
FEET
ORIGINAL SURFACE
POST SUBSIDENCE SURFACE
MAXIMUM 9.45 FT. DROP
VERTICAL EXAGGERATION
2.5 : 1
gate
barrier
(300')
gate
27 TR LW
gate
26 RT LW
gate
el. 3841
980'
13.5 ft MINING HEIGHT
0
400
800
1200
1600
2000
2400
2800
3200
FEET
SINGLE PANEL
SUBSIDENCE (ft)
0
5
10
INITIAL PILLAR
SUBSIDENCE
FINAL SUBSIDENCE
OVER PILLARS
PANEL
CENTERLINE
PANEL
CENTERLINE
POTENTIAL SURFACE
CRACKING STRAIN
0.02
0.01
0.0
0.01
TENSILE STRAIN
(in/in)
COMPRESSION STRAIN
(in/in)

thick, mining height is 13.5 feet, the subsidence factor is 70 percent, and angle of draw is 22.5 degrees. Under these conditions the maximum final surface subsidence would be 9.8 feet, which would occur over the middle of each panel. Final subsidence over the pillars between 2 panels, while not reaching the maximum, would still be about 5 feet. In diagram B, the dashed line indicates the limit of subsidence resulting from a single panel and the upper solid line represents the extent of subsidence (about 2.5 feet) immediately after mining the adjacent panel. The lower solid line represents the maximum final subsidence over the pillars after they have collapsed under the weight of the overburden. Diagram C shows the compressional strain that occurs above the panels and the tensile strain that occurs at panel boundaries and over pillars as the rocks flex and stretch downward into the subsidence trough. In this example, the tensile strain exceeds the strain criterion recommended by Singh and Bhattacharya (1984) in those areas above the panel boundaries and the pillars; surface cracking would be predicted in these areas, with larger maximum tensile strains possibly resulting in wider cracks. The exact location and actual width of open surface cracks is unpredictable.

A monitoring program is generally implemented at underground mines to collect subsidence data. These data are used to verify the accuracy of the predicted subsidence under actual ground conditions and to detect mining-induced impacts to surface resources, both predicted and unpredicted. In addition, site specific angle of draw, subsidence factor, and tensile strains may be calculated. These results can be used to refine the predictive model, which then can be used to estimate the effects of mining in successive longwall panels during the remainder of the mine life.

A number of techniques and types of equipment can be used in subsidence monitoring programs. These include: conventional ground surveying of monuments located over panels and extending out over unmined areas; installation of extensometers to measure horizontal strain; aerial photographic surveying; analytical aerial triangulation; digital terrain modeling; surface observations; and well, surface water, and spring monitoring. Monuments, to be effective, must be constructed so as to be unaffected by movements unrelated to subsidence, such as soil heave due to freezing.

d. The Subsidence Event

The nature of subsidence, when load of the overburden is high compared with the rock strengths (that is, when the mined seam is fairly deep), may be summarized as follows:

- Sufficient coal is removed to open up the mine void and the roof support system is withdrawn or advanced.
- The immediate roof is fragmented and "bulks" into the mined area, while a percentage of the mining height (i.e., the subsidence factor) subsides all the way to the surface. The surface sags downward behind the advancing front of the mining activity. The

subsidence trough formed at the surface (controlled by the angle of draw) is wider than the mined area.

- The advance of the mining activity also extends the deformation in the overburden. As the overburden rocks bend into the subsidence trough, new ground is placed in tension and new fractures open up. As the mining face passes under and progresses away from a particular point, the area of tensile stress moves away as well. Settling accompanied by compression takes over behind the area of stress and the tensional fractures tend to close. As successive areas are mined, this activity takes the form of a smooth subsidence wave. Pillars collapse under the overburden load when panels or rooms are mined on both sides of those pillars. This collapse can help to smooth out surface irregularities and help to close some of the remaining surface cracks. Massive sandstones in the overburden can also assist in smoothing out irregularities when they act as "beams" and produce a more complete collapse of pillars.

- Subsidence movement over longwall mines, and room-and-pillar mines where pillars have been robbed, tends to be relatively short-lived. Ninety to 95 percent of the subsidence is expected to occur once coal extraction in an area is complete (Dunrud 1984). Residual subsidence should be complete within 2 to 5 years after mining has ceased. Some delayed subsidence may occur over pillars that deteriorate slowly.

- Subsidence movement over room-and-pillar mines where pillars have been left behind tends to occur much slower, depending on the design and height of the pillars, and how much overburden weight rests on each pillar. Natural deterioration processes will eventually weaken the strongest pillar and cause it to collapse.

In situations where a mined area is fairly shallow and where massive sandstones in the roof provide some support to the overburden load, subsidence can occur abruptly with the entire load falling as a unit. Here, the surface expression may not be as smooth as that described above and larger cracks could result.

APPENDIX D

ROLES OF STATE AND FEDERAL AGENCIES IN PROJECT APPROVAL

State of Montana
Department of State Lands (DSL)
Coal and Uranium Bureau

Montana DSL is responsible for regulating coal mining operations within the State of Montana.

In April 1980, pursuant to Section 503 of the Federal Surface Mining Control and Reclamation Act (SMCRA) of 1977 as amended, the Secretary of the Interior approved Montana's permanent regulatory program, based on the Montana Strip and Underground Mine Reclamation Act (MSUMRA) of 1973 as amended, and its implementing regulations. Approval of the permanent program authorized Montana DSL to regulate surface coal-mining operations and surface effects of underground coal mining on non-Federal lands within the State. In April 1981, pursuant to Section 523(c) of SMCRA, Montana DSL entered into a cooperative agreement with the Secretary of the Interior authorizing Montana DSL to regulate surface coal-mining operations and surface effects of underground coal mining on Federal lands within the State.

Coal operators in Montana are required to submit detailed permit application packages (PAPs) to Montana DSL for proposed mining and reclamation operations in the State. Montana DSL reviews the PAP to ensure that the permit application complies with permitting requirements and that the coal mining operation will meet the performance standards of the approved Montana State permanent program, the Montana Environmental Policy Act, and other statutes. If it does comply, Montana DSL issues the applicant a *permit to conduct coal mining operations*. Montana DSL enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies.

State of Montana
Department of State Lands (DSL)
Board of Land Commissioners

Among the duties of the Board of Land Commissioners are the granting of *right-of-way use agreements* to railroads for the use of sections of land owned by the State and the lease of State-owned coal. These duties are specified in the Montana Code Annotated, 77-3-301 et seq. and 77-2-101 et seq., respectively. The Lands Division administers the rules implementing these statutes.

U.S. Department of the Interior
Office of Surface Mining Reclamation and Enforcement (OSM)

Prior to mining of Federal coal or affecting Federal surface estate, Meridian would have to obtain permits from OSM. OSM has primary responsibility to administer programs that regulate surface coal-mining operations and the surface effects of underground coal-mining operations.

Pursuant to the Montana cooperative agreement with the Secretary of the Interior, Federal coal lease holders and prospective coal operators affecting Federal surface estate in Montana must submit a PAP, containing a detailed mining plan and Federal permit application, to OSM for proposed mining and reclamation operations on Federal lands in the State. OSM and other Federal agencies review the PAP to ensure that it complies with the terms of the coal lease, the Mineral Leasing Act (MLA) of 1920 as amended, the National Environmental Policy Act (NEPA) of 1969 and other applicable Federal laws and their attendant regulations.

For those operations on leased Federal coal, OSM recommends approval, approval with conditions, or disapproval of the mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the mining plan can be approved, certain other Federal agencies, including the surface-managing agency, must concur with this recommendation. If all approvals and concurrences are received, OSM issues a Federal *permit to conduct coal mining operations* for those activities proposed on Federal lands.

Although Montana DSL enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies, OSM retains oversight responsibility of this enforcement.

U.S. Department of the Interior
Bureau of Land Management (BLM)

BLM is responsible for administering the Federal Land Policy and Management Act (FLPMA) of 1976 and certain provisions of the MLA on BLM-administered Federal lands.

Individuals or companies wishing to develop BLM-administered lands for private purposes must submit an application, containing a detailed plan of development to the BLM. BLM reviews the proposal for compliance with the resource management plan, Section 302 of FLPMA, and other Federal laws, including NEPA. BLM establishes a fair market rental fee for the subject property and issues a Federal *land use permit*.

Prospective coal lessees must submit an application to BLM to lease Federal coal estate in Montana. BLM reviews the application for compliance with the resource management plan, the MLA, and other Federal laws, including NEPA; determines the fair market value for the coal resource; and holds a competitive lease sale. If the sale is successful, BLM issues a Federal *coal lease* to the highest, qualified bidder who meets or exceeds the fair market value.

Federal coal lease-holders in Montana, pursuant to the Montana cooperative agreement with the Secretary of the Interior, must submit a PAP containing a detailed resource recovery and protection plan to BLM for proposed coal removal operations on Federal lands in the State.

BLM reviews the PAP to ensure maximum economic recovery of the Federal coal resource and compliance with the MLA. Before the mining plan can be approved by the Secretary of the Interior, BLM must concur with OSM's recommendation on the mining plan.

Although Montana DSL enforces the performance standards and permit requirements during the mine's operation and has primary authority in environmental emergencies, BLM has authority in those emergency situations where Montana DSL or OSM inspectors cannot act before significant environmental harm or damage occurs.

Copies of Meridian's surface use permit applications can be reviewed by the public at the BLM offices listed in Chapter I.

U.S. Interstate Commerce Commission (ICC)
Office of Transportation Analysis

ICC is responsible for administering the Interstate Commerce Act, and the economic regulation of interstate surface transportation within the United States, including rail line construction and operation.

Parties seeking to construct and operate a rail line must file an application or a petition for exemption. The application must contain complete information concerning the applicant, its financial standing, the proposed transportation plan, specifics on the proposed construction and operation activities, and pertinent environmental data (49 CFR 1150). The Commission reviews the application and ensures compliance with the Interstate Commerce Act and all other applicable Federal laws and their attendant regulations. If the rail proposal is approved by the Commission, the ICC will issue a *certificate of public convenience and necessity* permitting construction and operation of the rail line.

An alternative procedure is the filing of a *petition seeking exemption of the project* from the prior approval requirements. This procedure may be used where the petitioner demonstrates that regulation is not necessary and the project is of limited scope and will not adversely affect shippers (49 CFR 1121).

1. Other Federal Responsibilities

U.S. Department of the Interior
Fish and Wildlife Service (USFWS)

Nature of responsibility: Consults on mitigation proposals for impacts to protected wildlife and vegetation species under their jurisdiction. Concurs on the biological opinion for impacts to threatened, endangered, or proposed species of fish, wildlife, or plants.

Authority: The Endangered Species Act of 1973 as amended, the Migratory Bird Treaty Act, the Bald Eagle Protection Act of 1973, and the Fish and Wildlife Coordination Act as amended.

U.S. Department of the Interior
Mine Safety and Health Administration (MSHA)

Nature of responsibility: Issues permits that cover roof control, ventilation, and other aspects of operational safety.
Authority: Mine Safety and Health Act of 1977.

U.S. Department of the Army
Corps of Engineers (Corps)

Nature of responsibility: Issues permits for the discharge of dredged materials or the placement of fill materials into the waters of the United States, including adjacent wetlands.
Authority: Section 404 of the Clean Water Act.

U.S. Department of the Treasury
Bureau of Alcohol, Tobacco, and Firearms

Nature of responsibility: Issues permits to purchase, store, and use explosives.
Authority: P.L. 91-452.

U.S. Federal Communications Commission (FCC)

Nature of responsibility: Issues licenses to operate industrial radio service and/or a remote, FM-radio base station at frequencies which do not interfere with existing frequencies within the transmitter range.
Authority: The Communications Act of 1934 as amended.

2. Other State Responsibilities

State of Montana
State Historical Society
State Historic Preservation Officer (SHPO)

Nature of responsibility: Seeks a determination from the Keeper of the National Register for sites believed to be eligible for listing in the National Register of Historic Places. Issues a *State Antiquities Act permit*.
Authority: The archaeological provisions of MSUMRA, the Montana Antiquities Act, and the National Historic Preservation Act within the State of Montana.

State of Montana
Department of Health and Environmental Sciences (DHES)
Air Quality Bureau

Nature of responsibility: Issues a State *air quality permit* and an *open burning permit*.
Authority: The Montana Clean Air Act.

State of Montana
Department of Health and Environmental Sciences (DHES)
Water Quality Bureau

Nature of responsibility: Issues a *State Pollutant Discharge Elimination System permit.*
Authority: The Montana Water Quality Act.

State of Montana
Department of Natural Resources and Conservation (DNRC)
Water Resources Division

Nature of responsibility: Approves *water use permits*, assigns water rights, and approves dam designs. The agency grants *water use permits* for wells producing 35gpm or more. Permit holders may be inspected at random after obtaining a permit.

Prior to construction of a dam with over 50-acre feet normal capacity, a *hazard classification* must be applied for. There is no regular monitoring by the agency after the hazard classification is obtained.
Authority: The Montana Water Use Act.

State of Montana
Department of Natural Resources and Conservation (DNRC)
Facility Siting Bureau

Nature of responsibility: Approves powerline upgrades over 69 kV and powerline extensions of 10 miles or more.
Authority: The Montana Major Facility Siting Act.

State of Montana
Department of Transportation (MDT)
Area Maintenance Bureau

Nature of responsibility: Issues a *road approach permit.*
Authority: Montana Code Annotated, 61-5-101 et seq.

State of Montana
Department of Transportation (MDT)
Motor Carrier Services Division

Nature of responsibility: Inspects common carriers to ensure that they do not exceed the load limits set for Montana highways.
Authority: Montana Code Annotated, 61-10-201 et seq.

APPENDIX E

TECHNICAL TABLES

TABLE E-1

Climatological Summary for Logan International Airport,
Billings, Montana

NORMALS, MEANS, AND EXTREMES

Month	Temperature							Normal Degree Days Base 65°F		Precipitation in Inches										
	Normal			Extremes						Water Equivalent							Snow, Ice Pellets			
	Daily Maximum	Daily	Monthly	Record Highest	Year	Record Lowest	Year	Heating	Cooling	Normal	Maximum	Year	Minimum	Year	Maximum in	Year	Maximum	Year	Maximum in	Year
(a)				45		45					45		45		45		45		41	
J	31.2	12.5	21.9	68	1953	-30	1937	1336	0	0.70	2.35	1972	0.04	1941	1.41	1972	27.7	1963	16.6	1972
F	37.1	17.7	27.4	72	1961	-38	1936	1053	0	0.64	1.77	1978	0.05	1977	0.61	1952	22.4	1978	9.0	1944
M	42.1	23.1	32.6	79	1978	-19	1951	1004	0	1.01	2.70	1954	0.13	1936	1.01	1973	27.6	1935	10.5	1964
A	55.8	33.4	44.6	87	1962	-5	1936	612	0	1.56	4.42	1955	0.06	1962	3.19	1978	42.3	1955	23.7	1955
M	65.7	43.3	54.5	96	1935	14	1954	333	8	2.08	6.97	1978	0.53	1937	2.83	1952	7.7	1967	5.7	1967
J	73.7	51.5	62.6	102	1966	32	1969	131	59	2.61	7.64	1944	0.24	1961	2.78	1937	2.0	1950	2.0	1950
J	85.6	58.0	71.8	106	1937	41	1972	10	220	0.87	3.12	1958	0.07	1976	1.87	1958	0.0		0.0	
A	93.8	56.3	70.1	105	1961	40	1939	15	173	1.00	3.50	1965	0.05	1955	2.47	1965	0.0		0.0	
S	71.3	46.5	58.9	100	1950	25	1972	221	38	1.39	4.99	1941	0.06	1964	2.19	1966	6.3	1962	6.3	1962
O	61.0	37.5	49.3	90	1963	3	1971	487	0	0.88	3.80	1971	0.02	1948	1.98	1974	23.1	1949	10.0	1949
N	45.0	26.4	35.7	73	1975	-22	1959	879	0	0.73	2.34	1978	T	1954	1.37	1959	25.2	1978	15.3	1959
D	35.8	17.7	26.8	69	1957	-26	1964	1184	0	0.68	2.00	1973	0.05	1957	0.96	1978	28.8	1955	13.7	1978
					JUL		FEB					JUN		NOV		APR		APR		APR
YR	57.3	35.3	46.3	106	1937	-38	1936	7265	498	14.15	7.64	1944	T	1954	3.19	1978	42.3	1955	23.7	1955

NORMALS, MEANS, AND EXTREMES

Month	Relative Humidity Pct.				Wind					Pct. of Possible Sunshine	Mean Sky Cover, tenths, Sunrise to Sunset	Mean Number of Days											Average Station pressure mb. Elev. 3,570 feet m.s.l.
	Hour 05	Hour 11	Hour 17	Hour 23	Mean Speed m.p.h.	Prevailing Direction	Fastest Mile					Sunrise to sunset			Precipitation .01 or more	Snow, Ice Pellets 1.0 inch of more	Thunderstorms	Heavy Fog, Visibility ¼ Mile or Less	Temperatures °F Max.		Min.		
	(Local Time)						Speed m.p.h.	Direction	Year			Clear	Partly Cloudy	Cloudy					(b) 90°F Above	32°F and	32°F and Below	0°F and Below	
(a)	20	20	20	20	40	15	36	36		40	40	40	40	40	45	37	40	32	20	20	20	20	7
J	64	61	58	64	13.1	SW	66	W	1953	47	7.2	5	8	18	8	4	*	1	0	16	28	10	890.9
F	65	58	53	62	12.5	SW	72	W	1963	54	7.1	4	8	16	7	3	*	2	0	8	25	3	890.3
M	67	53	46	61	11.7	SW	61	NW	1956	62	7.1	4	9	18	9	3	*	2	0	6	24	2	887.6
A	68	50	42	60	11.7	SW	72	NW	1947	59	7.1	4	9	17	10	2	1	3	0	1	14	0	889.0
M	69	48	43	60	11.0	NE	68		1939	61	6.6	6	10	15	11	*	4	1	*	0	2	0	889.1
J	71	47	41	59	10.4	SW	79	NW	1968	64	5.9	7	12	11	11	*	8	1	3	0	*	0	889.9
J	63	39	31	49	9.7	SW	73	N	1947	77	4.0	14	12	5	7	0	8	*	12	0	0	0	892.0
A	60	40	30	46	9.7	SW	66	N	1947	76	4.2	14	11	6	6	0	6	*	11	0	0	0	891.7
S	66	48	38	54	10.4	SW	61	NW	1949	68	5.1	10	10	10	7	*	2	1	2	0	1	0	892.8
O	63	49	41	55	11.1	SW	68	NW	1949	62	5.7	9	10	12	6	1	*	2	*	1	8	0	892.4
N	66	58	54	62	12.3	SW	63	NW	1948	46	6.8	6	8	16	6	2	0	2	0	6	23	1	891.6
D	64	60	57	63	13.2	WSW	66	NW	1953	45	6.8	6	9	16	7	3	*	2	0	12	28	4	889.9
YR	66	51	44	58	11.4	SW	79	NW	JUN 1968	62	6.1	89	116	160	95	19	29	18	28	49	151	19	890.6

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Highest temperatures 112 in July 1901; lowest temperature -49 in February 1989; minimum monthly precipitation 0.00 in October 1896.

(a) Length or record, years, through the current year unless otherwise noted, based on January data.
(b) 70°F and Above at Alaskan stations.
* Less than on half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed in fastest observed 1-minute value when the direction is tens of degrees.

Source: Ruffner 1980.

TABLE E-2
Bull Mountains Mine No. 1
Spring Information

Spring Number	Location[1] (TRS ¼ ¼)	Within Life-of-Mine Area	Elev.[2] (ft.)	Flow Range (gpm)	Flow Average (gpm)	Specific Cond.[3] (μmhos/cm)	Development
11115	T6N,R27E, SEC 6 Cb	No	4004	0.1-1.5	0.7	2023	2 Steel Tanks
11125	T6N,R27E, SEC 6 Cb	No	3960	Dry-0.3	0.03	1847	No Development
11185	T6N,R26E, SEC 12 Aa	No	3849	Pond	Pond	2276	1 Large Pond
11555	T6N,R26E, SEC 2 Ac	No	3870	Dry-Pond	Pond	2700	No Development
14115	T6N,R27E, SEC 16 Dd	Yes	4460	0.8-3.3	1.8	542	1 Steel Tank
14155	T6N,R27E, SEC 15 Cd	Yes	4440	Pond-3.8	0.9	718	No Development
14165	T6N,R27E, SEC 15 Cb	Yes	4340	Pond-1.6	1.6	930	No Development
14255	T6N,R27E, SEC 16 Ac	Yes	4203	0.3-30.0	7.9	1001	1 Small Pond
14325	T6N,R27E, SEC 17 Aa	Yes	4095	1.0-39.0	12.5	1144	2 Large Ponds
14415	T6N,R27E, SEC 8 Dc	Yes	4070	Pond-1.5	0.3	1314	1 Small Pond
14535	T6N,R27E, SEC 8 Ca	Yes	4000	Pond-0.5	0.1	1540	No Development
14555	T6N,R27E, SEC 8 Ca	Yes	4070	Dry-0.3	0.1	1360	1 Small Pond
14655	T6N,R27E, SEC 8 Bb	No	4040	Dry-1.0	0.2	1644	No Development
14755	T6N,R27E, SEC 6 Dc	No	4000	Dry-0.3	0.04	2492	1 Small Pond
14785	T6N,R27E, SEC 7 Ac	No	3925	0.3-6.0	1.0	1867	1 Large Pond
16135	T6N,R27E, SEC 22 Cb	Yes	4486	1.0-18.0	7.3	556	Stream Channel Flow
16145	T6N,R27E, SEC 21 Da	Yes	4480	0.3-3.5	1.8	598	Stream Channel Flow
16165	T6N,R27E, SEC 21 Ad	Yes	4440	Dry-1.3	0.6	899	No Development
16255	T6N,R27E, SEC 21 Ac	Yes	4368	Pond-23.5	4.7	792	No Development
16275	T6N,R27E, SEC 21 Ac	Yes	4350	Pond-3.0	0.6	747	1 Small Pond
16355	T6N,R27E, SEC 21 Ba	Yes	4282	2.3-66.0	17.2	828	Stream Channel Flow
16365	T6N,R27E, SEC 21 Bb	Yes	4237	0.3-24.0	9.2	832	Stream Channel Flow
16625	T6N,R27E, SEC 17 Db	Yes	4118	0.1-3.0	1.5	1904	No Development
16655	T6N,R27E, SEC 17 Ac	Yes	4069	11.5-68.0	16.2	1137	1 Large Pond
16755	T6N,R27E, SEC 17 Ab	Yes	4176	0.1-1.0	0.4	1549	1 Steel Tank
16855	T6N,R27E, SEC 17 Bb	Yes	4041	Pond-0.5	0.2	2771	No Development
16955	T6N,R27E, SEC 18 Aa	Yes	3961	Dry-41.8	6.0	1417	No Development
17115	T6N,R27E, SEC 33 Ba	No	4550	Pond-1.5	0.8	825	1 Small Pond
17145	T6N,R27E, SEC 28 Cd	No	4483	0.1-4.3	1.4	994	1 Wood Tank
17165	T6N,R27E, SEC 28 Cb	No	4360	Pond-2.3	0.3	1144	1 Large Pond
17185	T6N,R27E, SEC 29 Ad	No	4302	0.1-9.0	3.9	1390	Pond and Tank
17215	T6N,R27E, SEC 28 Ac	No	4500	Pond-1.5	0.6	916	1 Small Ponds
17255	T6N,R27E, SEC 28 Bc	No	4310	Pond	Pond	925	1 Small Pond
17275	T6N,R27E, SEC 29 Aa	No	4276	0.3-10.0	3.8	1220	1 Steel Tank
17315	T6N,R27E, SEC 20 Dc	No	4188	1.5-11.0	5.1	1270	1 Small Pond 1 Deep Well Not in Use
17415	T6N,R27E, SEC 20 Bc	Yes	4071	0.2-30.7	9.5	1705	2 Large Ponds
17515	T6N,R27E, SEC 17 Cc	Yes	4014	0.1-6.5	2.1	1776	1 Small Pond
17635	T6N,R27E, SEC 21 Bd	Yes	4470	Pond-1.5	0.6	896	1 Small Pond
17655	T6N,R27E, SEC 21 Bc	Yes	4250	Dry-5.0	1.7	1506	No Development
17685	T6N,R27E, SEC 20 Aa	Yes	4150	0.8-12.0	6.5	1861	1 Small Pond
31555	T7N,R27E, SEC 18 Bc	No	3610	Pond	Pond	1885	1 Small Pond
41125	T6N,R27E, SEC 6 Ba	No	4136	0.3-2.0	0.6	1853	2 Small Ponds
41135	T7N,R27E, SEC 31 Cd	No	4100	Pond	Pond	1975	1 Large Pond
41155	T7N,R27E, SEC 31 Bc	No	4075	Dry	Dry	--	No Development
41165	T7N,R27E, SEC 31 Ab	No	3980	Pond	Pond	NA[4]	1 Small Pond
41175	T7N,R27E, SEC 31 Ab	No	4010	Pond	Pond	1855	1 Small Pond
41185	T7N,R27E, SEC 31 Ba	No	4020	Pond	Pond	1864	1 Pond and Tank
41215	T6N,R27E, SEC 6 Ba	No	4419	0.1-1.0	0.4	628	1 Steel Tank

TABLE E-2 (Continued)

TABLE E-2
Bull Mountains Mine No. 1
Spring Information

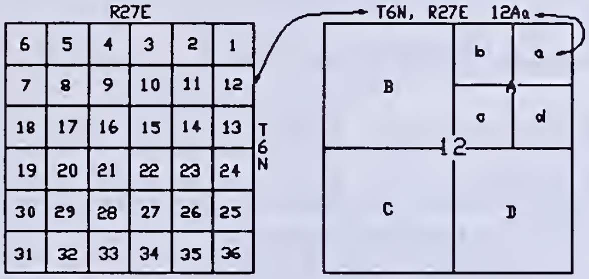
Spring Number	Location[1] (TRS ¼ ¼)	Within Life-of-Mine Area	Elev.[2] (ft.)	Flow Range (gpm)	Flow Average (gpm)	Specific Cond.[3] (μmhos/cm)	Development
41225	T7N,R27E, SEC 32 Dc	No	4200	Dry-0.3	0.1	1448	No Development
41275	T7N,R27E, SEC 31 Aa	No	4010	Pond	Pond	1475	1 Small Pond
41315	T7N,R27E, SEC 30 Db	No	3955	Pond	Pond	NA[4]	NA[4]
41335	T7N,R27E, SEC 30 Db	No	3960	Pond	Pond	2697	1 Steel Tank
41425	T7N,R26E, SEC 25 Cd	No	4030	Pond	Pond	1816	1 Steel Tank
41445	T7N,R26E, SEC 25 Db	No	3970	NA[4]	NA[4]	NA[4]	NA[4]
41545	T7N,R27E, SEC 29 Ab	No	3870	Pond	Pond	3550	1 Small Pond
41555	T7N,R27E, SEC 20 Cd	No	3840	NA[4]	NA[4]	2050	No Development
41575	T7N,R27E, SEC 20 Cd	No	3800	Dry	Dry	--	Old Mine Entry
41585	T7N,R27E, SEC 16 Cc	No	3680	Pond	Pond	1465	1 Small Pond
41625	T7N,R27E, SEC 28 Bc	No	3940	Pond	Pond	3713	1 Large Pond
41635	T7N,R27E, SEC 28 Bc	No	3920	NA[4]	NA[4]	1810	No Development
41665	T7N,R27E, SEC 21 Bc	No	3740	Pond	Pond	1993	1 Small Pond
41685	T7N,R27E, SEC 16 Ca	No	3655	Pond	Pond	1730	1 Large Pond
41755	T7N,R27E, SEC 22 Bb	No	3610	NA[4]	NA[4]	NA[4]	NA[4]
41825	T7N,R27E, SEC 22 Bb	No	3700	NA[4]	NA[4]	NA[4]	NA[4]
41925	T7N,R27E, SEC 14 Db	No	3775	NA[4]	NA[4]	NA[4]	NA[4]
41945	T7N,R27E, SEC 14 Ca	No	3740	NA[4]	NA[4]	NA[4]	NA[4]
41985	T7N,R27E, SEC 15 Ba	No	3580	Pond	Pond	1445	1 Small Pond
51175	T7N,R27E, SEC 26 Cc	No	3740	0.3-1.8	0.6	2034	No Development
51255	T7N,R27E, SEC 36 Db	No	3707	0.5-6.3	3.5	2450	No Development
51445	T7N,R27E, SEC 26 Cb	No	3780	Dry-Pond	Pond	1060	No Development
51465	T7N,R27E, SEC 26 Bd	No	3700	Dry-Pond	Pond	2332	No Development
51485	T7N,R27E, SEC 26 Ab	No	3655	Dry	Dry	-	No Development
52125	T6N,R27E, SEC 9 Da	Yes	4200	Pond-6.0	1.2	1278	1 Small Pond
52145	T6N,R27E, SEC 9 Ad	Yes	4060	Dry-Pond	Pond	1103	1 Small Pond
52165	T6N,R27E, SEC 3 Cc	Yes	3980	Pond-3.3	1.0	1749	2 Small Ponds
52225	T6N,R27E, SEC 9 Bd	Yes	4072	0.3-2.3	0.7	1552	No Development
52235	T6N,R27E, SEC 9 Bd	Yes	4100	Dry-0.5	0.1	1690	No Development
52255	T6N,R27E, SEC 9 Bb	Yes	4090	Dry-0.1	0.02	1889	No Development
52275	T6N,R27E, SEC 4 Dd	Yes	3960	Dry-0.8	0.1	1871	No Development
52355	T6N,R27E, SEC 4 Ca	Yes	4038	Dry-2.0	0.5	1542	No Development
52365	T6N,R27E, SEC 4 Ca	Yes	4028	Dry	Dry	--	No Development
52375	T6N,R27E, SEC 4 Ac	Yes	3950	Dry-0.8	0.1	1768	Pond
52455	T6N,R27E, SEC 3 Bc	Yes	3840	0.8-10.2	4.4	2042	2 Small Ponds
52525	T6N,R27E, SEC 5 Ab	No	4286	0.1-2.0	0.6	772	1 Steel Tank
52535	T6N,R27E, SEC 5 Aa	No	4110	1.0-6.0	2.6	910	No Development
52545	T7N,R27E, SEC 33 Cb	No	4100	Pond-0.3	0.2	1485	No Development
52565	T7N,R27E, SEC 33 Dc	No	3960	Dry	Dry	-	No Development
52655	T7N,R27E, SEC 34 Cd	No	3788	0.1-24.0	3.5	2165	No Development
52855	T7N,R27E, SEC 35 Bd	No	3690	Pond-1.5	0.2	2223	No Development
53115	T6N,R27E, SEC 15 Dc	Yes	4340	Pond-7.8	1.9	700	No Development
53125	T6N,R27E, SEC 15 Dc	Yes	4400	0.3-2.0	0.9	683	No Development
53145	T6N,R27E, SEC 15 Ac	Yes	4180	Pond-0.5	0.2	1132	No Development
53155	T6N,R27E, SEC 15 Ac	Yes	4180	Pond-6.0	1.9	1058	No Development
53175	T6N,R27E, SEC 15 Aa	Yes	4038	Pond-12.0	2.4	1033	1 Large Pond
53195	T6N,R27E, SEC 11 Ca	No	3917	Pond-19.8	4.9	1448	No Development

TABLE E-2
Bull Mountains Mine No. 1
Spring Information

Spring Number	Location[1] (TRS ¼ ¼)	Within Life-of-Mine Area	Elev.[2] (ft.)	Flow Range (gpm)	Flow Average (gpm)	Specific Cond.[3] (μmhos/cm)	Development
53225	T6N,R27E, SEC 14 Ca	Yes	4113	Dry-0.5	0.1	1979	No Development
53245	T6N,R27E, SEC 14 Bd	Yes	3980	Dry-0.5	0.1	2789	No Development
53285	T6N,R27E, SEC 11 Cd	Yes	3980	Pond-3.5	0.5	2458	2 Small Ponds
53325	T6N,R27E, SEC 13 Ca	No	4100	Dry-3.3	0.8	3972	No Development
53335	T6N,R27E, SEC 13 Cb	No	4080	Pond-0.6	0.2	4356	No Development
53385	T6N,R27E, SEC 11 Dc	No	3940	Dry-1.0	0.1	3597	No Development
53415	T6N,R27E, SEC 11 Bd	No	3880	Dry-10.3	1.8	2351	No Development
53455	T6N,R27E, SEC 11 Ba	No	3820	Pond-4.5	1.2	1962	No Development
53465	T6N,R27E, SEC 2 Cd	No	3800	Pond-0.8	0.1	1741	No Development
53475	T6N,R27E, SEC 2 Dc	No	3815	Pond-9.8	1.6	2067	No Development
53485	T6N,R27E, SEC 2 Dc	No	3802	1.5-9.5	4.0	2348	No Development
53495	T6N,R27E, SEC 2 Db	No	3780	Pond-0.3	0.03	2379	No Development
53525	T6N,R27E, SEC 10 Bd	Yes	4040	Pond-0.5	0.1	2461	No Development
53535	T6N,R27E, SEC 10 Bd	Yes	4040	Dry-0.3	0.04	1760	1 Small Pond
53545	T6N,R27E, SEC 10 Bd	Yes	4000	Pond-0.1	0.02	2473	No Development
53575	T6N,R27E, SEC 10 Aa	No	3890	Pond-0.8	0.2	1748	No Development
53615	T6N,R27E, SEC 13 Ac	No	4080	Dry-3.3	1.0	3330	No Development
53635	T6N,R27E, SEC 13 Ba	No	4030	Dry-1.3	0.4	3620	No Development
53685	T6N,R27E, SEC 2 Da	No	3780	Pond-1.0	0.1	1796	No Development
53755	T6N,R27E, SEC 2 Bc	No	3800	Pond-3.5	1.4	1443	1 Large Pond
53855	T7N,R27E, SEC 35 Cd	No	3760	Dry-Pond	Pond	1118	No Development
71115	T6N,R27E, SEC 22 Ab	Yes	4416	1.3-9.0	4.3	488	2 Steel Tanks
71125	T6N,R27E, SEC 22 Bd	Yes	4460	Pond-1.0	0.4	527	No Development
71355	T6N,R27E, SEC 23 Dc	No	4060	Pond-1.8	0.4	2688	No Development
71425	T6N,R27E, SEC 24 Cc	No	3920	Dry-0.8	0.2	1236	1 Large Pond
71445	T6N,R27E, SEC 24 Cc	No	3900	Pond-1.5	0.4	1738	No Development
71465	T6N,R27E, SEC 24 Cd	No	3868	2.0-16.5	7.8	1432	1 Steel Tank
72115	T6N,R27E, SEC 27 Bb	No	4540	Pond-1.3	0.6	424	1 Steel Tank
72125	T6N,R27E, SEC 27 Ba	No	4340	0.3-3.0	1.8	862	1 Steel Tank
72135	T6N,R27E, SEC 27 Ba	No	4340	0.3-1.5	0.5	1009	No Development
72155	T6N,R27E, SEC 27 Ac	No	4216	0.3-16.7	4.1	1117	No Development
72175	T6N,R27E, SEC 27 Da	No	4140	Pond-7.0	1.2	1609	1 Small Pond
72185	T6N,R27E, SEC 26 Cc	No	4064	Pond-6.5	2.3	2071	1 Large Pond
92155	T7N,R26E, SEC 25 Cb	No	3830	Pond	Pond	2361	1 Small Pond

TABLE E-2
Bull Mountains Mine No. 1
Spring Information

[1] Locations for the springs use USGS designations for 1/4 1/4 sections. This diagram illustrates that for a spring located in the NE corner of Township 6 North (T6N), Range 27 East (R27E), Section 12 (Sec 12) the 1/4 1/4 designation would be "Aa".



[2] Elevations surveyed or estimated from USGS 7.5 minute topographic maps.

[3] CLASSIFICATION OF GROUNDWATER (MONTANA ADMINISTRATIVE RULE 16.20.1002)
CLASS I - <1,000 μmhos/cm
CLASS II - 1,000 to 2,500 μmhos/cm
CLASS III - 2,500 to 15,000 μmhos/cm
CLASS IV - >15,000 μmhos/cm

[4] NA - Data Not Available

[*] Classification (ARM 16.20.1002) of Ground water

"The ground waters of the State of Montana are classified as follows:

(a) Class I ground waters are generally suitable for public and private water supplies, culinary and food processing purposes, irrigation, livestock and wildlife watering, and for commercial and industrial purposes with little or no treatment. Class I ground waters have a specific conductance of less than 1000 micromhos/cm at 25°C.

(b) Class II ground waters are generally marginally suitable for public and private water supplies, culinary and food processing uses and are suitable for irrigation of some agricultural crops, for drinking water for most wildlife and livestock, and for most commercial and industrial purposes. Class II ground waters may be used for municipal or domestic water supplies in areas where better quality water is not readily available. Class II ground waters have specific conductance ranging from 1000 to 2500 micromhos/cm at 25°C.

(c) Class III ground waters are suitable for some industrial and commercial uses and as drinking water for some wildlife and livestock and for irrigation of some salt-tolerant crops using special water management practices. In some cases Class III ground waters are the only economically feasible source for municipal or domestic water supplies. Class III ground waters have specific conductance ranging from 2500 to 15,000 micromhos/cm at 25°C.

(d) Class IV ground waters may be suitable for some industrial, commercial and other uses, but are unsuitable or, for practical purposes, untreatable for higher class beneficial uses. These ground waters have specific conductance greater than 15,000 micromhos/cm at 25°C."

TABLE E-3
Bull Mountains Mine No. 1
Hydrology Matrix for Spring Ranking

WATER AVAILABILITY	SCORE
ALL YEAR	4
OCCASIONALLY FROZEN	3
OCCASIONALLY DRY AND/OR FROZEN	2
FREQUENTLY DRY	1

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AVERAGE FLOW GALLONS PER MINUTE (GPM)	SCORE
> 10 GPM	4
5 TO 10 GPM	3
1 TO 5 GPM	2
< 1 GPM	1

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AVERAGE QUALITY MONTANA ARM 16 20 1002 CRITERIA	SCORE
CLASS I	4
CLASS II	3
CLASS III	2
CLASS IV	1

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HYDROLOGY SCORE USED IN TABLE III-3 CUMULATIVE

TABLE E-4
Bull Mountains Mine No. 1
Aquatic Ecology Matrix for Spring Ranking

HABITAT DIVERSITY **(RELATES TO HABITAT FORM PROVIDING THE DEGREE OF MULTIPLE USE)**	SCORE
HABITAT IS PERENNIAL AND IN THE FORM OF SPRING FLOW WITH PONDED WATER	4
HABITAT IS PERENNIAL AND IN THE FORM OF SPRING FLOW WITH STREAM POOLS	3
HABITAT IS PERENNIAL AND IN THE FORM OF SPRING SEEPAGE	2
HABITAT IS INTERMITTENT AND IN THE FORM OF SPRING SEEPAGE	1

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HABITAT EXTENT **(RELATES TO AMOUNT OF HABITAT IN FORM AND FUNCTION)**	SCORE
HABITAT IS PERENNIAL WITH HIGH EXTENT	4
HABITAT IS PERENNIAL WITH MODERATE EXTENT	3
HABITAT IS PERENNIAL WITH LOW EXTENT	2
HABITAT IS LIMITED IN EXTENT AND SEASONAL AVAILABILITY	1

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MARCOINVERTEBRATE DIVERSITY **(RELATES TO NUMBERS OF INDIVIDUALS AND TAXA FOUND SEASONALLY)**	SCORE
DIVERSITY AND DENSITY ARE HIGH	4
DIVERSITY AND DENSITY ARE MODERATE	3
DIVERSITY AND DENSITY ARE LOW	2
DIVERSITY AND DENSITY ARE LIMITED	1

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PERIPHYTON DIVERSITY **(RELATES TO NUMBERS OF INDIVIDUALS AND TAXA FOUND SEASONALLY)**	SCORE
DIVERSITY AND DENSITY ARE HIGH	4
DIVERSITY AND DENSITY ARE MODERATE	3
DIVERSITY AND DENSITY ARE LOW	2
DIVERSITY AND DENSITY ARE LIMITED	1

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AQUATICS SCORE USED IN TABLE III-3 CUMULATIVE

TABLE E-5
Bull Mountains Mine No. 1
Hydrophytic Vegetation Matrix for Spring Ranking

SPRING DESCRIPTION	VEGETATION SCORE USED IN TABLE III-3 CUMULATIVE
NATIVE PLANTS VERY DOMINANT, OVERALL SPECIES DIVERSITY AND DIVERSITY OF HYDROPHYTIC ZONES HIGH, LARGE AREAL EXTENT OF HYDROPHYTIC VEGETATION. RELATIVELY LOW MANIFESTATION OF RECENT DISTURBANCE.	4
NATIVE PLANTS DOMINANT OVER INTRODUCED SPECIES, OVERALL SPECIES DIVERSITY AND DIVERSITY OF HYDROPHYTIC ZONES MODERATELY HIGH, MODERATELY LARGE AREAL EXTENT OF HYDROPHYTIC VEGETATION. MODERATE RECENT DISTURBANCE.	3
NATIVE AND INTRODUCED PLANTS CO-DOMINANT, SPECIES AND ZONAL DIVERSITY MODERATE, MODERATE OR SMALL AREAL EXTENT. RECENT DISTURBANCE OFTEN EXTENSIVE.	2
INTRODUCED PLANTS OFTEN DOMINANT, SPECIES AND ZONAL DIVERSITY LOW, SMALL AREAL EXTENT. RECENT DISTURBANCE OFTEN EXTENSIVE.	1

TABLE E-6
Bull Mountains Mine No. 1
Land Use Matrix for Spring Ranking

SPRING DEVELOPMENT (RELATES TO TYPE AND AMOUNT OF DEVELOPMENT)	**SCORE**
SPRING IS DEVELOPED WITH LARGE POND AND/OR OTHER WATER PRODUCING STRUCTURE	4
SPRING IS DEVELOPED WITH SMALL POND	3
SPRING IS DEVELOPED WITH STOCK TANK	2
SPRING HAS NO DEVELOPMENT	1

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RANCH USE (RELATED TO IMPORTANCE OF SPRING AND POSITION RELAVTIVE TO RANCH AND PASTURE USE)	**SCORE**
SPRING IS OF HIGH USE FOR RANCH OPERATIONS	4
SPRING IS OF MODERATE USE FOR RANCH OPERATIONS	4
SPRING IS OF LOW USE FOR RANCH OPERATIONS	2
SPRING IS OF LIMITED USE FOR RANCH OPERATIONS	1

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ECOLOGICAL IMPORTANCE (RELATES TO IMPORTANCE AND POSITION OF SPRING RELATIVE TO ECOLOGICAL SURROUNDINGS)	**SCORE**
SPRING IS OF HIGH IMPORTANCE	3
SPRING IS OF MODERATE IMPORTANCE	3
SPRING IS OF LOW IMPORTANCE	2
SPRING IS OF LIMITED IMPORTANCE	1

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LAND USE SCORE USED IN TABLE III-3 CUMULATIVE

TABLE E-7
Bull Mountains Mine No. 1
Wildlife Matrix for Spring Ranking

SPRING DESCRIPTION	WILDLIFE SCORE USED IN TABLE III-3 CUMULATIVE
PERENNIAL, GOOD TO EXCELLENT HABITAT, WITH GOOD TOPOGRAPHIC AND/OR VEGETATIVE COVER, OPEN WATER. LITTLE OR NO LIVESTOCK USE.	4
GENERALLY PERENNIAL, OFTEN A LONG REACH OF PARTIALLY OPEN WATER, FAIR TOPOGRAPHIC AND/OR VEGETATIVE COVER. LIGHT TO MODERATE LIVESTOCK USE.	3
MAY HAVE SOME DESIRABLE CHARACTERISTICS FOR WILDLIFE, BUT GENERALLY LIMITED BY LOW FLOWS, INTERMITTENT NATURE. HEAVY LIVESTOCK USE, OR LIMITED COVER.	2
SEVERELY LIMITED DUE TO LOW FLOW, LITTLE OR NO TOPOGRAPHIC AND/OR VEGETATIVE COVER. HEAVY LIVESTOCK USE.	1

TABLE E-8
Bull Mountains Mine No. 1
Spring Impact Potential, Relative Importance of Potentially-Impacted Springs, and Severity of Impacts

Spring	Location[1] (TRS¼¼)	Within Life-of-Mine Area	Potential for Impact	Relative Importance of Potentially-Impacted Springs[2]	Severity of Impact[3] Prior to Mitigation
11115	T6N,R27E, SEC 6 CB	No	None		
11125	T6N,R27E, SEC 6 CB	No	None		
11185	T6N,R26E, SEC 12 AA	No	None		
11555	T6N,R26E, SEC 2 AC	No	None		
14115	T6N,R27E, SEC 16 DD	Yes	Low	Low	Negligible
14155	T6N,R27E, SEC 15 CD	Yes	Low	Low	Negligible
14165	T6N,R27E, SEC 15 CB	Yes	Moderate	Moderate	Potential to Become Major
14255	T6N,R27E, SEC 16 AC	Yes	Moderate	Major	Major
14325	T6N,R27E, SEC 17 AA	Yes	Moderate	Major	Major
14415	T6N,R27E, SEC 8 DC	Yes	Moderate	Moderate	Potential to Become Major
14535	T6N,R27E, SEC 8 CA	Yes	Moderate	Negligible	Negligible
14555	T6N,R27E, SEC 8 CA	Yes	Moderate	Low	Negligible
14655	T6N,R27E, SEC 8 BB	No	None		
14755	T6N,R27E, SEC 6 DC	No	None		
14785	T6N,R27E, SEC 7 AC	No	None		
16135	T6N,R27E, SEC 22 CB	Yes	Low	Low	Negligible
16145	T6N,R27E, SEC 21 DA	Yes	Moderate	Low	Negligible
16165	T6N,R27E, SEC 21 AD	Yes	Moderate	Moderate	Potential to Become Major
16255	T6N,R27E, SEC 21 AC	Yes	Moderate	Low	Negligible
16275	T6N,R27E, SEC 21 AC	Yes	Moderate	Low	Negligible
16355	T6N,R27E, SEC 21 BA	Yes	Moderate	Moderate	Potential to Become Major
16365	T6N,R27E, SEC 21 BB	Yes	Moderate	Moderate	Potential to Become Major
16625	T6N,R27E, SEC 17 DB	Yes	Moderate	Low	Negligible
16655	T6N,R27E, SEC 17 AC	Yes	Moderate	Major	Major
16755	T6N,R27E, SEC 17 AB	Yes	High	Low	Potential to Become Major
16855	T6N,R27E, SEC 17 BB	Yes	Moderate	Negligible	Negligible
16955	T6N,R27E, SEC 18 AA	Yes	High	Low	Negligible
17115	T6N,R27E, SEC 33 BA	No	None		
17145	T6N,R27E, SEC 28 CD	No	None		
17165	T6N,R27E, SEC 28 CB	No	None		
17185	T6N,R27E, SEC 29 AD	No	None		
17215	T6N,R27E, SEC 28 AC	No	None		
17255	T6N,R27E, SEC 28 BC	No	None		
17275	T6N,R27E, SEC 29 AA	No	None		
17315	T6N,R27E, SEC 20 DC	No	None		
17415	T6N,R27E, SEC 20 BC	Yes	Low	Major	Potential to Become Major
17515	T6N,R27E, SEC 17 CC	Yes	High	Moderate	Major
17635	T6N,R27E, SEC 21 BD	Yes	Moderate	Low	Negligible
17655	T6N,R27E, SEC 21 BC	Yes	Moderate	Low	Negligible

TABLE E-8
Bull Mountains Mine No. 1
Spring Impact Potential, Relative Importance of Potentially-Impacted Springs, and Severity of Impacts

Spring	Location[1] (TRS¼¼)	Within Life-of-Mine Area	Potential for Impact	Relative Importance of Potentially-Impacted Springs[2]	Severity of Impact[3] Prior to Mitigation
17685	T6N,R27E, SEC 20 AA	Yes	Low	Moderate	
31555	T7N,R27E, SEC 18 BC	No	None		
41125	T6N,R27E, SEC 6 BA	No	None		
41135	T7N,R27E, SEC 31 CD	No	None		
41155	T7N,R27E, SEC 31 BC	No	None		
41165	T7N,R27E, SEC 31 AB	No	None		
41175	T7N,R27E, SEC 31 AB	No	None		
41185	T7N,R27E, SEC 31 BA	No	None		
41215	T6N,R27E, SEC 6 BA	No	None		
41225	T7N,R27E, SEC 32 DC	No	None		
41275	T7N,R27E, SEC 31 AA	No	None		
41315	T7N,R27E, SEC 30 DB	No	None		
41335	T7N,R27E, SEC 30 DB	No	None		
41425	T7N,R26E, SEC 25 CD	No	None		
41445	T7N,R26E, SEC 25 DB	No	None		
41545	T7N,R27E, SEC 29 AB	No	None		
41555	T7N,R27E, SEC 20 CD	No	None		
41575	T7N,R27E, SEC 20 CD	No	None		
41585	T7N,R27E, SEC 16 CC	No	None		
41625	T7N,R27E, SEC 28 BC	No	None		
41635	T7N,R27E, SEC 28 BC	No	None		
41665	T7N,R27E, SEC 21 BC	No	None		
41685	T7N,R27E, SEC 16 CA	No	None		
41755	T7N,R27E, SEC 22 BD	No	None		
41825	T7N,R27E, SEC 22 BD	No	None		
41925	T7N,R27E, SEC 14 DB	No	None		
41945	T7N,R27E, SEC 14 CA	No	None		
41985	T7N,R27E, SEC 15 BA	No	None		
51175	T7N,R27E, SEC 26 CC	No	None		
51255	T7N,R27E, SEC 36 DB	No	None		
51445	T7N,R27E, SEC 26 CB	No	None		
51465	T7N,R27E, SEC 26 BD	No	None		
51485	T7N,R27E, SEC 26 AB	No	None		
52125	T6N,R27E, SEC 9 DA	Yes	Moderate	Moderate	Potential to Become Major
52145	T6N,R27E, SEC 9 AD	Yes	Moderate	Low	Negligible
52165	T6N,R27E, SEC 3 CC	Yes	Negligible		
52225	T6N,R27E, SEC 9 BD	Yes	Moderate	Low	Negligible
52235	T6N,R27E, SEC 9 BD	Yes	Moderate	Low	Negligible
52255	T6N,R27E, SEC 9 BB	Yes	Moderate	Negligible	Negligible
52275	T6N,R27E, SEC 4 DD	Yes	Negligible		
52355	T6N,R27E, SEC 4 CA	Yes	None		
52365	T6N,R27E, SEC 4 CA	Yes	None		

TABLE E-8 (Continued)

TABLE E-8
Bull Mountains Mine No. 1
Spring Impact Potential, Relative Importance of Potentially-Impacted Springs, and Severity of Impacts

Spring	Location[1] (TRS¼¼)	Within Life-of-Mine Area	Potential for Impact	Relative Importance of Potentially-Impacted Springs[2]	Severity of Impact[3] Prior to Mitigation
52375	T6N,R27E, SEC 4 AC	Yes	None		
52455	T6N,R27E, SEC 3 BC	Yes	Negligible		
52525	T6N,R27E, SEC 5 AB	No	None		
52535	T6N,R27E, SEC 5 AA	No	None		
52545	T7N,R27E, SEC 33 CB	No	None		
52565	T7N,R27E, SEC 33 DC	No	None		
52655	T7N,R27E, SEC 34 CD	No	Negligible		
52855	T7N,R27E, SEC 35 BD	No	None		
53115	T6N,R27E, SEC 15 DC	Yes	Moderate	Low	Negligible
53125	T6N,R27E, SEC 15 DC	Yes	Moderate	Low	Negligible
53145	T6N,R27E, SEC 15 AC	Yes	High	Low	Potential to Become Major
53155	T6N,R27E, SEC 15 AC	Yes	High	Low	Potential to Become Major
53175	T6N,R27E, SEC 15 AA	Yes	Moderate	Moderate	Potential to Become Major
53195	T6N,R27E, SEC 11 CA	No	Negligible	Moderate	Negligible
53225	T6N,R27E, SEC 14 CA	Yes	Moderate	Low	Negligible
53245	T6N,R27E, SEC 14 BD	Yes	High	Low	Potential to Become Major
53285	T6N,R27E, SEC 11 CD	Yes	Negligible		
53325	T6N,R27E, SEC 13 CA	No	None		
53335	T6N,R27E, SEC 13 CB	No	None		
53385	T6N,R27E, SEC 11 DC	No	None		
53415	T6N,R27E, SEC 11 BD	No	None		
53455	T6N,R27E, SEC 11 BA	No	Negligible		
53465	T6N,R27E, SEC 2 CD	No	Negligible		
53475	T6N,R27E, SEC 2 DC	No	Negligible		
53485	T6N,R27E, SEC 2 DC	No	Negligible		
53495	T6N,R27E, SEC 2 DB	No	Negligible		
53525	T6N,R27E, SEC 10 BD	Yes	High	Low	Potential to Become Major
53535	T6N,R27E, SEC 10 BD	Yes	High	Low	Potential to Become Major
53545	T6N,R27E, SEC 10 BD	Yes	Moderate	Low	Potential to Become Major
53575	T6N,R27E, SEC 10 AA	No	None		
53615	T6N,R27E, SEC 13 AC	No	None		
53635	T6N,R27E, SEC 13 BA	No	None		
53685	T6N,R27E, SEC 2 DA	No	None		
53755	T6N,R27E, SEC 2 BC	No	None		
53855	T7N,R27E, SEC 35 CD	No	None		
71115	T6N,R27E, SEC 22 AB	Yes	Moderate	Low	Negligible
71125	T6N,R27E, SEC 22 BD	Yes	Moderate	Low	Negligible
71355	T6N,R27E, SEC 23 DC	No	None		

TABLE E-8
Bull Mountains Mine No. 1
Spring Impact Potential,
Relative Importance of Potentially-Impacted Springs,
and Severity of Impacts

Spring	Location[1] (TRS¼¼)	Within Life-of-Mine Area	Potential for Impact	Relative Importance of Potentially-Impacted Springs[2]	Severity of Impact[3] Prior to Mitigation
71425	T6N,R27E, SEC 24 CC	No	Negligible		
71445	T6N,R27E, SEC 24 CC	No	Negligible		
71465	T6N,R27E, SEC 24 CD	No	Negligible		
72115	T6N,R27E, SEC 27 BB	No	None		
72125	T6N,R27E, SEC 27 BA	No	None		
72135	T6N,R27E, SEC 27 BA	No	None		
72155	T6N,R27E, SEC 27 AC	No	None		
72175	T6N,R27E, SEC 27 DA	No	None		
72185	T6N,R27E, SEC 26 CC	No	None		
92155	T7N,R26E, SEC 25 CB	No	None		

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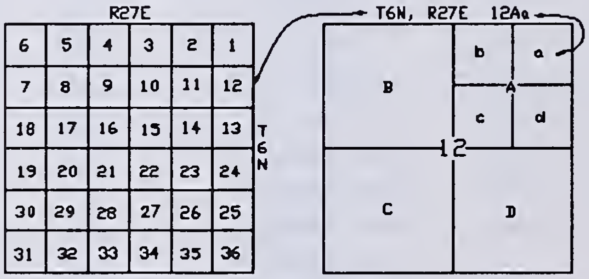
[1] Locations for the springs use USGS designations for 1/4 1/4 sections. This diagram illustrates that for a spring located in the NE corner of Township 6 North (T6N), Range 27 East (R27E), Section 12 (Sec 12) the 1/4 1/4 designation would be "Aa".



[2] For explanation of method used to derive "Relative Importance of Potentially-Impacted Springs" rating see accompanying tables E-3 through E-7, Appendix E.

TABLE E-9
List of Species

Scientific and Common Names of Vegetation Species*

Scientific Name	Common Name
Agropyron cristatum	crested wheatgrass
Agropyron intermedium	intermediate wheatgrass
Agropyron smithii	western wheatgrass
Agropyron spicatum	bluebunch wheatgrass
Artemisia cana	silver sagebrush
Bouteloua gracilis	blue grama
Bromus japonicus	Japanese brome
Bromus tectorum	cheatgrass
Carex filifolia	threadleaf sedge
Carex nebraskensis	Nebraska sedge
Carex spp.	sedge
Centaurea maculosa	spotted knapweed
Cirsium arvense	Canada thistle
Distichlis stricta	inland saltgrass
Hordeum jubatum	foxtail barley
Juncus balticus	wire rush
Juncus bufonis	toad rush
Juniperus scopulorum	Rocky Mountain juniper
Koleria cristata	prairie junegrass
Lactuca serriola	prickly lettuce
Medicago sativa	alfalfa
Pinus ponderosa	ponderosa pine
Poa pratensis	Kentucky bluegrass
Poa sandbergii	sandberg bluegrass
Puccinellia nuttalliana	Nuttall's alkaligrass
Rosa woodsii	woods rose
Sarcobatus vermiculatus	greasewood
Scirpus acutus	western bulrush
Scirpus spp.	bulrush
Stipa comata	needle-and-thread
Stipa viridula	green needlegrass
Suaeda depressa	seepweed
Symphoricarpos albus	snowberry
Symphoricarpos occidentalis	snowberry
Taraxacum officinale	dandelion
Typha latifolia	cattail

* Species mentioned in Chapt. 3

TABLE E-10
List of Species

Common and Scientific Names of Wildlife Species*

Common Name	Scientific Name
MAMMALS	
Nuttall's cottontail	*Sylvilagus nuttalli*
Least chipmunk	*Tamius minimus*
Richardson's ground squirrel	*Spermophilus richardsonii*
Coyote	*Canis latrans*
Rocky Mt.Elk	*Cervus elaphus*
Mule deer	*Odocoileus hemionus*
White-tailed deer	*Odocoileus virginianus*
Pronghorn	*Antilocapra americana*
Blacktail prairie dog	*Cynomys ludovicianus*
BIRDS	
Bald Eagle	*Haliaeetus leucocephalus*
Turkey vulture	*Cathartes aura*
Northern harrier	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Swainson's hawk	*Buteo swainsoni*
Red-tailed hawk	*Buteo jamaicensis*
Ferruginous hawk	*Buteo regalis*
Rough-legged hawk	*Buteo lagopus*
American kestrel	*Falco sparvarius*
Prairie falcon	*Falco mexicanus*
Sharp-tailed grouse	*Tympanuchus phasianellus*
Wild turkey	*Meleagris gallopavo*
Great horned owl	*Bubo virginianus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Mountain bluebird	*Sialia currocoides*
Cliff swallow	*Hirundo pyrrhonata*

* Species mentioned in Chapter 3.

TABLE E-11.
Birds Observed Along Proposed Railway Corridor Which Were Primarily Associated with Wetlands

Species	Breeding Pairs or Territorial Defense	Broods	Unknown Status
Green-winged teal	X		
Mallard	X	X	
Northern pintail	X		
Blue-winged teal	X		
Cinnamon teal	X		
Northern shoveler	X		
Gadwall	X		
American wigeon	X		
Redhead			X
Lesser scaup	X		
American avocet	X		
Willet		X	
Long-billed curlew	X		
Long-billed dowitcher			X
Wilson's phalarope		X	

TABLE E-12

Employment in Montana, Musselshell County, and Yellowstone County - 1980 and 1989

	Montana				Musselshell County				Yellowstone County			
	1980		1989		1980		1989		1980		1989	
Employment Sector	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Total Employment	389,460	100.0	421,539	100.0	1,944	100.0	1,850	100.0	60,286	100.0	68,964	100.0
Farm	32,870	8.4	31,024	7.4	332	17.1	331	17.9	1,378	2.3	1,311	1.9
Nonfarm	356,590	91.6	390,515	92.6	1,612	82.9	1,519	82.1	58,908	97.7	67,653	98.1
Private	281,449	72.3	312,959	74.2	1,349	69.4	1,276	69.0	51,017	84.6	59,382	86.1
Agricultural Services	3,726	1.0	5,748	1.4	31	1.6	40	2.2	445	0.7	573	0.8
Mining	9,619	2.5	7,005	1.7	278	14.3	116	6.3	783	1.3	589	0.9
Construction	22,324	5.7	20,193	4.8	75	3.9	99	5.4	3,523	5.8	3,205	4.6
Manufacturing	26,225	6.7	24,730	5.9	69	3.5	52	2.8	4,454	7.4	3,359	4.9
Transportation and Utilities	26,194	6.7	23,616	5.6	92	4.7	114	6.2	4,865	8.1	4,667	6.8
Wholesale Trade	18,805	4.8	16,408	3.9	86	4.4	75	4.1	5,827	9.7	5,441	7.9
Retail Trade	68,756	17.7	76,561	18.2	331	17.0	298	16.1	12,231	20.3	14,274	20.7
Finance, Insurance, & Real Estate	22,922	5.9	26,128	6.2	74	3.8	51	2.8	4,414	7.3	5,766	8.4
Services	82,878	21.3	112,570	26.7	313	16.1	431	23.3	14,475	24.0	21,508	31.2
Government	75,141	19.3	77,556	18.4	263	13.5	243	13.1	7,891	13.1	8,271	12.0
Federal (civilian)	13,967	3.6	13,797	3.3	19	1.0	21	1.1	1,636	2.7	1,805	2.6
Federal (military)	9,256	2.4	9,562	2.3	26	1.3	26	1.4	679	1.1	745	1.1
State and Local	51,918	13.3	54,197	12.9	218	11.2	196	10.6	5,576	9.2	5,721	8.3

Source: U.S. Department of Commerce 1991.

TABLE E-13

Labor Force Statistics -
Montana, Musselshell County, and Yellowstone County
(Selected Years, 1970-1990)

Place/Category	1970	1980	1985	1986	1987	1988	1989	1990
Montana								
Civilian Labor Force	273,000	371,000	405,000	407,000	403,000	402,000	405,000	402,000
Employed Persons	261,000	348,000	374,000	374,000	373,000	374,000	381,000	379,000
Unemployed Persons	12,000	23,000	31,000	33,000	30,000	28,000	24,000	23,000
Unemployment Rate	4.4	6.2	7.7	8.1	7.4	7.0	5.9	5.7
Musselshell County								
Civilian Labor Force	1,440	1,841	1,984	1,961	1,883	1,865	1,782	1,696
Employed Persons	1,333	1,798	1,838	1,754	1,693	1,695	1,648	1,564
Unemployed Persons	107	43	146	207	190	170	134	132
Unemployment Rate	7.4	2.3	7.4	10.6	10.1	9.1	7.5	7.8
Yellowstone County								
Civilian Labor Force	35,170	55,542	61,749	61,423	60,043	59,518	61,870	64,473
Employed Persons	32,966	52,861	57,259	56,718	55,726	55,648	58,704	61,395
Unemployed Persons	2,204	2,681	4,490	4,705	4,317	3,870	3,166	3,078
Unemployment Rate	6.3	4.8	7.3	7.7	7.2	6.5	5.1	4.8

Source: Montana Department of Labor and Industry 1991.

TABLE E-14

Personal Income in Montana, Musselshell County, and Yellowstone County - 1980 and 1989
($000,000)

	Montana				Musselshell County				Yellowstone County			
	1980		1989		1980		1989		1980		1989	
Earnings Sector	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Total Personal Income	$7,039.6	100.0	$11,392.5	100.0	$42.2	100.0	$58.3	100.0	$1,107.2	100.0	$1,810.8	100.0
Total Earnings	5,070.8	72.0	7,366.8	64.7	23.5	55.6	29.3	50.2	862.4	77.9	1,275.4	70.4
Farm	280.2	4.0	474.4	4.2	1.7	4.1	5.5	9.5	7.0	0.6	25.1	1.4
Nonfarm	4,790.6	68.1	6,892.4	60.5	21.7	51.6	23.8	40.8	855.4	77.3	1,250.2	69.0
Private	3,830.7	54.4	5,373.7	47.2	19.1	45.4	19.7	33.9	751.6	67.9	1,079.0	59.6
Agricultural Services	29.0	0.4	52.7	0.5	0.3	0.6	0.6	1.0	4.3	0.4	6.3	0.3
Mining	240.4	3.4	247.7	2.2	6.5	15.3	2.6	4.5	16.6	1.5	17.6	1.0
Construction	445.9	6.3	405.2	3.6	1.1	2.6	1.4	2.3	74.9	6.8	67.1	3.7
Manufacturing	504.3	7.2	619.3	5.4	0.3	0.8	0.3	0.6	93.3	8.4	98.7	5.5
Transportation and Utilities	565.0	8.0	720.2	6.3	2.1	4.9	5.1	8.8	106.2	9.6	134.8	7.4
Wholesale Trade	337.6	4.8	386.5	3.4	2.2	5.2	1.5	2.5	114.3	10.3	143.7	7.9
Retail Trade	613.1	8.7	850.0	7.5	2.5	5.8	2.8	4.7	116.0	10.5	166.8	9.2
Finance, Insurance, & Real Estate	217.7	3.1	313.7	2.8	0.9	2.2	0.7	1.1	42.9	3.9	77.7	4.3
Services	877.7	12.5	1,778.5	15.6	3.4	8.1	4.8	8.2	183.1	16.5	366.3	20.2
Government	960.0	13.6	1,518.7	13.3	2.6	6.2	4.0	6.9	103.8	9.4	171.2	9.5
Federal (civilian)	257.7	3.7	394.2	3.5	0.3	0.7	0.6	1.0	33.6	3.0	59.5	3.3
Federal (military)	74.8	1.1	133.1	1.2	0.1	0.2	0.2	0.3	2.3	0.2	5.2	0.3
State and Local	627.4	8.9	991.4	8.7	2.2	5.3	3.3	5.6	68.0	6.1	106.6	5.9

Source: U.S. Department of Commerce May 1991.

TABLE E-15

Population by Age - Bull Mountains Study Area

Place/Age	1970	Percent of Total	1980	Percent of Total	1990	Percent of Total
Montana Total	694,409	100.0	786,690	100.0	799,065	100.0
0 to 4 Years	57,054	8.2	64,455	8.2	59,257	7.4
5 to 17 Years	196,071	28.2	167,440	21.3	162,847	20.4
18 to 64 Years	372,548	53.6	470,236	59.8	470,464	58.9
65+ Years	68,736	9.9	84,559	10.7	106,497	13.3
Musselshell Co. Total	3,734	100.0	4,428	100.0	4,106	100.0
0 to 4 Years	273	7.3	376	8.5	199	4.8
5 to 17 Years	934	25.0	937	21.2	844	20.6
18 to 64 Years	1,919	51.4	2,419	54.6	2,242	54.6
65+ Years	608	16.3	696	15.7	821	20.0
Roundup Total	1,564	100.0	2,116	100.0	1,808	100.0
0 to 4 Years	N/A	0.0	186	8.8	100	5.5
5 to 17 Years	N/A	0.0	343	16.2	357	19.7
18 to 64 Years	N/A	0.0	1,129	53.4	884	48.9
65+ Years	N/A	0.0	458	21.6	467	25.8
Yellowstone Co. Total	87,367	100.0	108,035	100.0	113,419	100.0
0 to 4 Years	7,068	8.1	9,013	8.3	8,418	7.4
5 to 17 Years	24,701	28.3	22,665	21.0	22,455	19.8
18 to 64 Years	48,534	55.6	66,516	61.6	68,547	60.4
65+ Years	7,064	8.1	9,841	9.1	13,999	12.3
Billings Total	61,581	100.0	66,842	100.0	81,151	100.0
0 to 4 Years	4,790	7.8	4,907	7.3	6,036	7.4
5 to 17 Years	16,928	27.5	12,606	18.9	14,785	18.2
18 to 64 Years	34,758	56.4	42,603	63.7	48,977	60.4
65+ Years	5,105	8.3	6,726	10.1	11,353	14.0

Note: N/A = Not Available

Source: U.S. Department of Commerce 1970, 1980, and 1990.

TABLE E-16

Baseline Economic Projections for Montana, Musselshell County, and Yellowstone County - 1990 to 2010

Place/Type	1990	1995	2000	2005	2010
Montana					
Population	799,065	824,591	849,782	873,195	897,738
Employment	426,923	454,890	483,126	506,978	523,272
Per Capita Income	$11,609	$13,101	$14,801	$16,692	$18,752
Musselshell County					
Population	4,106	4,238	4,389	4,436	4,615
Employment	1,858	1,897	1,955	2,013	2,052
Per Capita Income	$10,828	$12,143	$13,683	$15,422	$17,341
Yellowstone County					
Population	113,419	119,928	125,489	130,309	134,968
Employment	70,279	77,242	83,688	89,110	92,981
Per Capita Income	$12,780	$14,334	$16,139	$18,136	$20,330

Source: National Planning Association Data Services, Inc. 1990.

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